Service Manual

Life Scope TR

Bedside Monitor

BSM-6301/BSM-6501/BSM-6701

BSM-6000 series
BSM-6301A
BSM-6301K
BSM-6501A
BSM-6501K
BSM-6701A
BSM-6701K

0634-900184D

NIHON KOHDEN

If you have any comments or suggestions on this manual, please contact us at: www.nihonkohden.com

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GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dust, saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is combined with other instruments to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

(3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. **When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.**

10. **When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.**

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

CAUTION

United States law restricts this product to sale by or on the order of a physician.

EMC RELATED CAUTION

This equipment and/or system complies with IEC 60601-1-2 International Standard for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:
   Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.

2. Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. Effect of direct or indirect electrostatic discharge:
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. Electromagnetic interference with any radio wave receiver such as radio or television:
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

5. Interference of lightning:
   When lightning occurs near the location where the equipment and/or system is installed, it may induce an excessive voltage in the equipment and/or system. In such a case, disconnect the AC power cord from the equipment and/or system and operate the equipment and/or system by battery power, or use an uninterruptible power supply.

6. Use with other equipment:
   When the equipment and/or system is adjacent to or stacked with other equipment, the equipment and/or system may affect the other equipment. Before use, check that the equipment and/or system operates normally with the other equipment.

7. Use of unspecified accessory, transducer and/or cable:
   When an unspecified accessory, transducer and/or cable is connected to this equipment and/or system, it may cause increased electromagnetic emission or decreased electromagnetic immunity. The specified configuration of this equipment and/or system complies with the electromagnetic requirements with the specified configuration. Only use this equipment and/or system with the specified configuration.

Caution - continued

8. Use of unspecified configuration:
   When the equipment and/or system is used with the unspecified system configuration different than the configuration of EMC testing, it may cause increased electromagnetic emission or decreased electromagnetic immunity. Only use this equipment and/or system with the specified configuration.

9. Measurement with excessive sensitivity:
   The equipment and/or system is designed to measure bioelectrical signals with a specified sensitivity. If the equipment and/or system is used with excessive sensitivity, artifact may appear by electromagnetic interference and this may cause mis-diagnosis. When unexpected artifact appears, inspect the surrounding electromagnetic conditions and remove this artifact source.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden distributor or representative for additional suggestions.

In IEC 60601-1-2 Medical Electronic Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility-Requirements and test. Section 36. 202. 2 Radiated radio-frequency electromagnetic fields, PATIENT COUPLED EQUIPMENT and/or SYSTEMS applicable IMMUNITY test methods are under consideration at SC62A/WG13. The 3 V/m IMMUNITY level may be inappropriate especially when measuring SpO_2 because physiological signals can be much smaller than those induced by a 3 V/m electromagnetic field.

When measuring SpO_2, various interference may produce false waveforms which look like pulse waveforms. SpO_2 value and pulse rate may be measured from these false waveforms, causing the alarm to function improperly.

When installing the monitor, avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cellular phone or mobile two-way radios.

BSM-6301 and BSM-6501 (JA-690PA/JA-694PA data acquisition unit, QE-910P BIS processor and QI-320PA wireless LAN station are not connected) comply with International Standard IEC 60601-1-2: 2001 and Amendment 1: 2004 which requires CISPR11, Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

BSM-6301, BSM-6501 (JA-690PA/JA-694PA data acquisition unit, QE-910P BIS processor and QI-320PA wireless LAN station are not connected) and BSM-6701 comply with International Standard IEC 60601-1-2: 2001 and Amendment 1: 2004 which requires CISPR11, Group 1, Class A. Class A EQUIPMENT is equipment suitable for use in industrial or light industrial establishments and commercial environment.

BSM-6301 and BSM-6501 (when QE-910P and ZS-900P are connected) are CLASS A equipment if the equipment complies with IEC 60601-1-2: 2001 36 201.1.5 in the countries which do not have national wireless rule.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker representative or Nihon Kohden representative.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

The CE mark is a protected conformity mark of the European Community. Products with the CE mark comply with the requirements of the Medical Device Directive 93/42/EEC.

NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EEC
For the member states of the European Union only:
The purpose of WEEE directive 2002/96/EEC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.
Contact your Nihon Kohden representative for disposal.

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Text Conventions in this Manual

- Names of hard keys on the main unit are enclosed in square brackets: [Menu]
- Messages that are displayed on the screen are enclosed in quotation marks: “CHECK ELECTRODES”
- Names of items that are displayed on the screen are enclosed in angle brackets: <SENSITIVITY>

Related Documentation

The BSM-6301A/K, BSM-6501A/K and BSM-6701A/K bedside monitors come with the following manuals in addition to the operator’s manual.

Administrator’s Guide

Describes how to install the bedside monitor. It also explains about the password protected settings on the SYSTEM SETUP window and SYSTEM CONFIGURATION screen which only an administrator can change.

User’s Guide, Part I

Gives supplemental information on the operation of the bedside monitor.

User’s Guide, Part II

Describes the features and settings of the monitoring parameters.

Service Manual

Describes information on servicing the bedside monitor. Only qualified service personnel can service the bedside monitor.

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Introduction

This service manual provides useful information to qualified personnel to understand, troubleshoot, service, maintain and repair the BSM-6000A/K series bedside monitor.

The information in the operator's manual is primarily for the user. However, it is important for service personnel to thoroughly read the operator's manual and service manual before starting to troubleshoot, service, maintain or repair this monitor. This is because service personnel need to understand the operation of the monitor in order to effectively use the information in the service manual.

For simplicity, the model number suffix A/G/K is omitted in this manual. There is no difference in operation among models with different suffixes unless otherwise specified.

Precautions on Improper Use

This monitor's performance and safety are assured only by proper use as described in the service manual and the operator's manual. Nihon Kohden cannot be held responsible for problems caused by use other than indicated in the manuals.

General Information on Servicing

Note the following information when servicing the monitor.

CAUTION

Safety

- There is the possibility that the outside surface of the instrument, such as the operation keys, could be contaminated by contagious germs, so disinfect and clean the instrument before servicing it. When servicing the instrument, wear rubber gloves to protect yourself from infection.
- There is the possibility that when the lithium battery is broken, a solvent or toxic substance inside the lithium battery could leak out. If the solvent or toxic substance touches your skin or gets into your eye or mouth, immediately wash it with a lot of water and see a physician.

Liquid ingress

The instrument is not drip-proof, so do not install the instrument where water or liquid can get into or fall on the instrument. If liquid accidentally gets into the instrument or the instrument accidentally drops into liquid, disassemble the instrument, clean it with clean water and dry it completely. After reassembling, use the patient safety checks and function/performance checks to verify that there is nothing wrong. If there is something wrong with the instrument, contact your Nihon Kohden representative for repair.

Environmental Safeguards

Depending on the local laws in your community, it may be illegal to dispose of the lithium battery and CRT unit in the regular waste collection. Check with your local officials for proper disposal procedures.

Disinfection and cleaning

To disinfect the outside surface of the instrument, wipe it with a nonabrasive cloth moistened with any of the disinfectants listed below. Do not use any other disinfectants or ultraviolet rays to disinfect the instrument.

- Chlorhexidine gluconate solution: 0.5%
- Benzethonium chloride solution: 0.2%
- Glutaraldehyde solution: 2.0%
- Benzalkonium chloride: 0.2%
- Alkyldiaminoethylglycine hydrochloride: 0.5%

Transport

- Use the specified shipment container and packing material to transport the instrument. If necessary, double pack the instrument.

Also, put the instrument into the shipment container after packing so that the buffer material does not get inside the instrument.

- When transporting a board or unit of the instrument, be sure to use a conductive bag. Never use an aluminum bag when transporting the power board, power unit or board on which a lithium battery is mounted. Also, never wrap the board or unit of the instrument with styrene foam or a plastic bag which generates static electricity.

Handling the instrument

- Because the outside surface of the instrument is made of resin, it can be easily damaged. When handling the instrument, remove clutter from around the instrument and be careful not to damage the instrument or get it dirty.
- Because most of the boards in the instrument are multilayer boards with surface mounted electrical devices (SMD), a special tool is required when removing and soldering the electrical devices. To avoid damaging other electrical components, do not remove and solder SMD components yourself.

Measuring and Test Equipment

Maintain the accuracy of the measuring and test equipment by checking and calibrating it according to the check and calibration procedures.

Precautions on Handling Information

Personal medical information may be handled in the monitor. Observe the following points in repair or replacement.

- When the monitor is to be taken out from a facility, explain about that to the facility and obtain approval from the facility.
- Before the monitor is to be transferred from a facility or outside of the company, be sure to erase data by the system initialization (general).
- Before disposing of the MAIN DIGITAL board, take measures to completely disable data reading.

Precautions on Repair

- When packaging and transporting a monitor, use the designated package box and packaging materials. Perform double packaging as necessary. Be also sure to wrap the monitor before packaging in order to prevent intrusion of the cushioning material.
- When transporting boards, be sure to put it in a conductive bag. When transporting boards with batteries or other power supply components, never use aluminum foil. (For packaging, never use polystyrene foam, plastic bags or any other electrostatically sensitive materials.)
- The boards in this monitor use surface-mount components. Therefore, for removing components or soldering, special tools must be used. Be careful in the operation. Careless operation can cause damage to the printed circuit board itself or component failure. Check and calibrate jigs and measuring instruments used for repair and inspection according to the instruction in order to maintain a high accuracy.
- This monitor can be connected to the network of the facility where this monitor is installed, as well as to a special network. When performing a network connection work, observe the following notes.
  - First obtain the approval from the network administrator of the facility. Then follow their instruction throughout the work and setting operations.
  - Check that the connection is made by way of the LAN Isolation (HIT-100, part code: 676457).

Service Policy and Patient Safety Checks

Service Policy

Our technical service policy for the monitor is to replace the faulty unit, board or part or damaged mechanical part with a new one. Do not perform electrical device or component level repair of the multilayer board or unit. We do not support component level repair outside the factory for the following reasons:

- Most of the boards are multilayer boards with surface mounted electrical devices, so the mounting density of the board is too high.
- A special tool and special repair skill is required to repair the multilayer boards with surface mounted electrical devices.

Disassemble the monitor or replace a board or unit in an environment where the monitor is protected against static electricity.

As background knowledge for repair, pay special attention to the following:

- You can reduce the repair time by considering the problem before starting repair.
- You can clarify the source of most of the troubles using the information from the diagnostic check function of the monitor.

Patient Safety Checks

Periodic maintenance procedures and diagnostic check procedures are provided in this manual to ensure that the monitor is operating in accordance with its design and production specifications. To verify that the monitor is working in a safe manner with regard to patient safety, patient safety checks should be performed on the monitor before it is first installed, periodically after installation, and after any repair is made on the monitor.

For patient safety checks, perform the following checks as described in the International Electrotechnical Commission’s standard, IEC 60601-1: 1988.

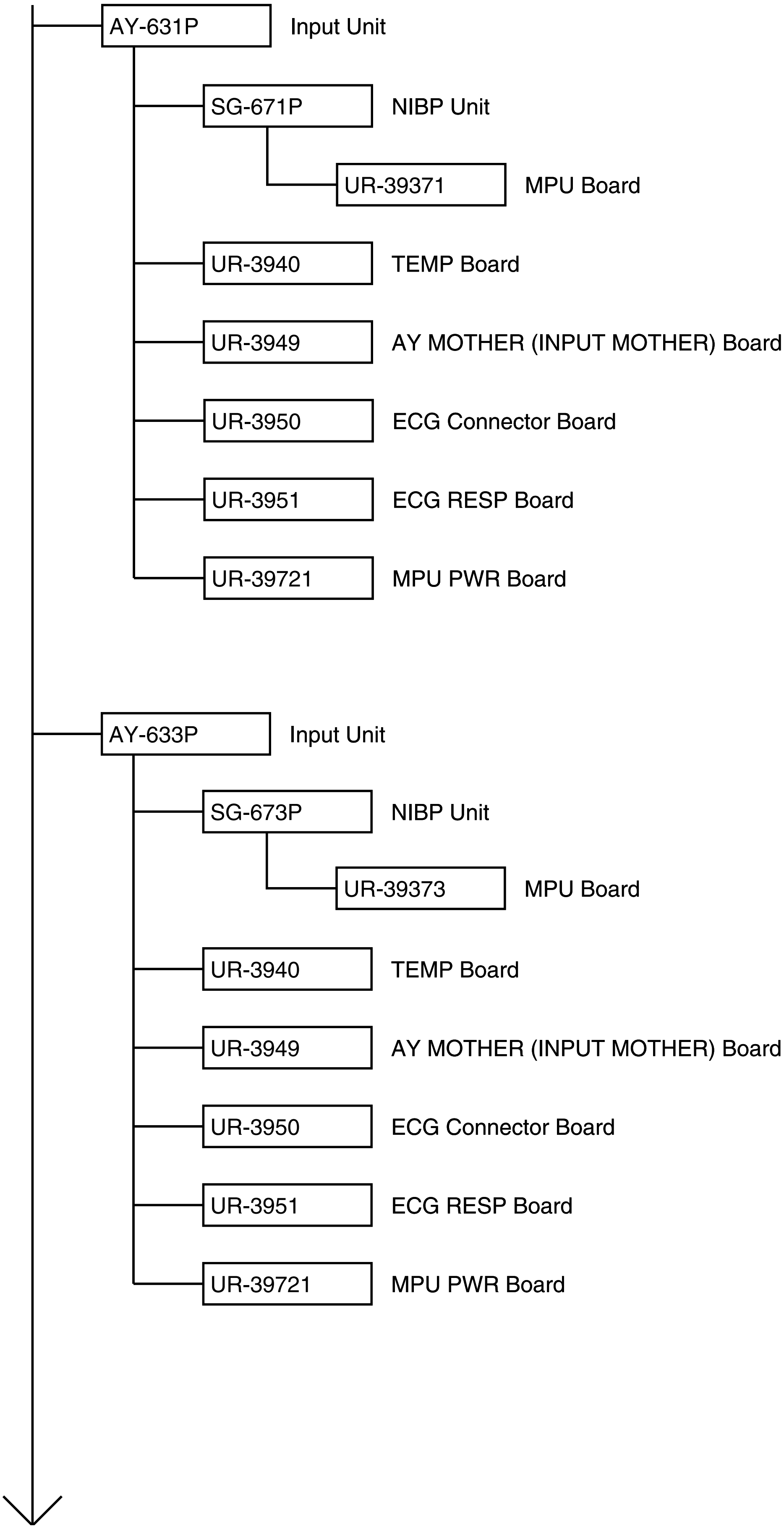
- Protective earth resistance check
- Earth leakage current check
- Enclosure leakage current check
- Patient leakage current check
- Withstanding voltage check

Composition

BSM-6301

- MU-631R Main Unit
  - SC-631R Power Unit (Heat sink chassis block included)
  - UR-39450 MAIN DIGITAL Board
  - UR-3956 FRONT I/F Board
  - UR-3957 BATT MOTHER 0 Board
  - UR-39591 BATT MOTHER 1 Board
  - UR-3962 Front Mother Board Set
    - UR-3953* Power SW Board
    - UR-3954* Operation Board
    - UR-3955* Alarm Board
    - UR-3983* Touch Panel I/F Board
    - UR-3984* Record Key Board

    * Not available
  - UR-3966 INPUT I/F Board
- AA-672P Smart Expansion Unit
  - UR-39462 EXTMPU Board
  - UR-3947 EXTMPU PWR Board
- AA-674P Smart Expansion Unit
  - UR-39464 EXTMPU Board
  - UR-3947 EXTMPU PWR Board


AY-631P
Input Unit
SG-671P
NIBP Unit
UR-39371
MPU Board
UR-3940
TEMP Board
UR-3949
AY MOTHER (INPUT MOTHER) Board
UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
UR-39721
MPU PWR Board
AY-633P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3940
TEMP Board
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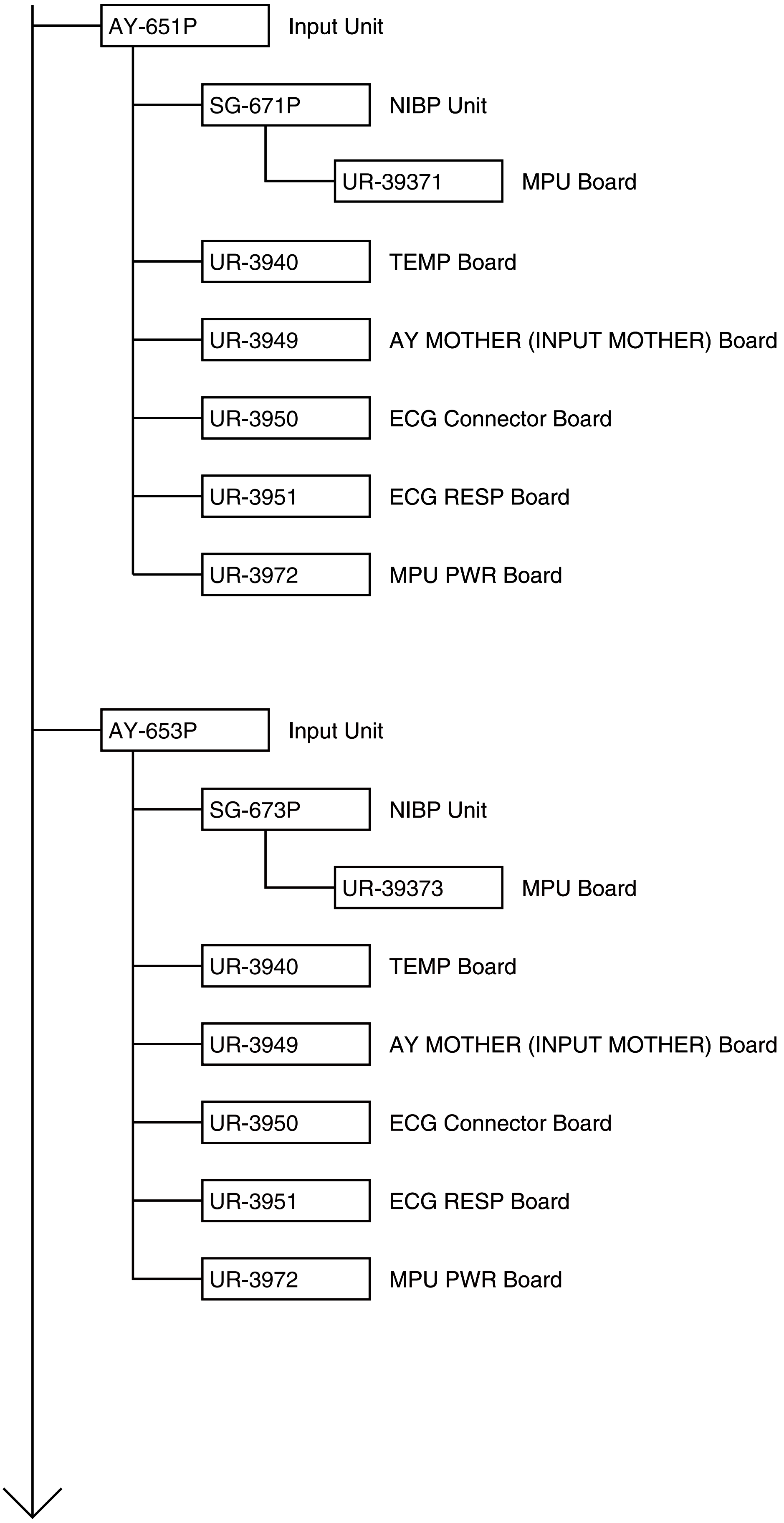
ECG RESP Board
UR-39721
MPU PWR Board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Input Unit
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UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
UR-3972
MPU PWR Board
AY-653P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3940
TEMP Board
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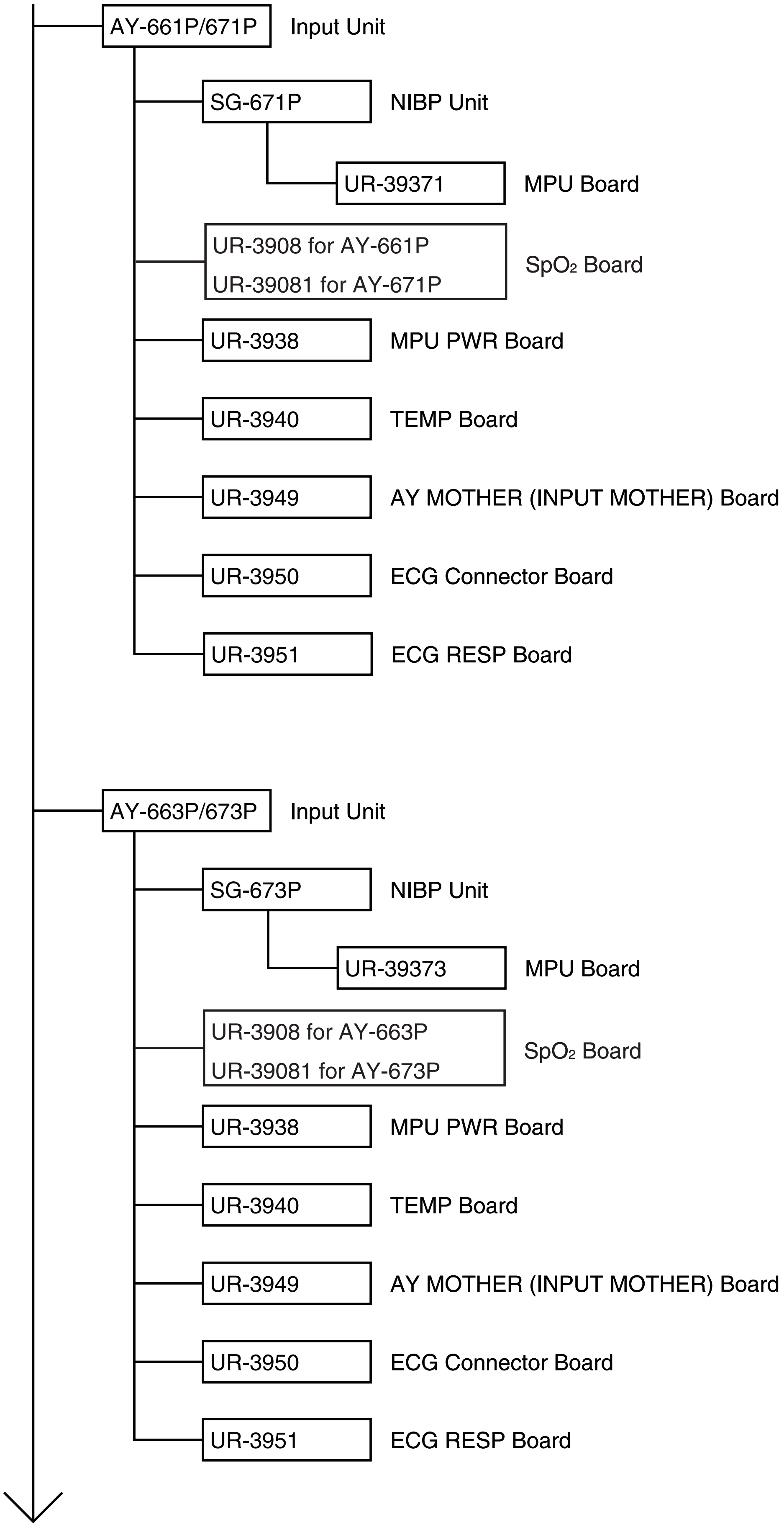
UR-3972
MPU PWR Board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Input Unit
SG-671P
NIBP Unit
UR-39371
MPU Board
UR-3908 for AY-661P
UR-39081 for AY-671P
SpO₂ Board
UR-3938
MPU PWR Board
UR-3940
TEMP Board
UR-3949
AY MOTHER (INPUT MOTHER) Board
UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
AY-663P/673P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3908 for AY-663P
UR-39081 for AY-673P
SpO₂ Board
UR-3938
MPU PWR Board
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TEMP Board
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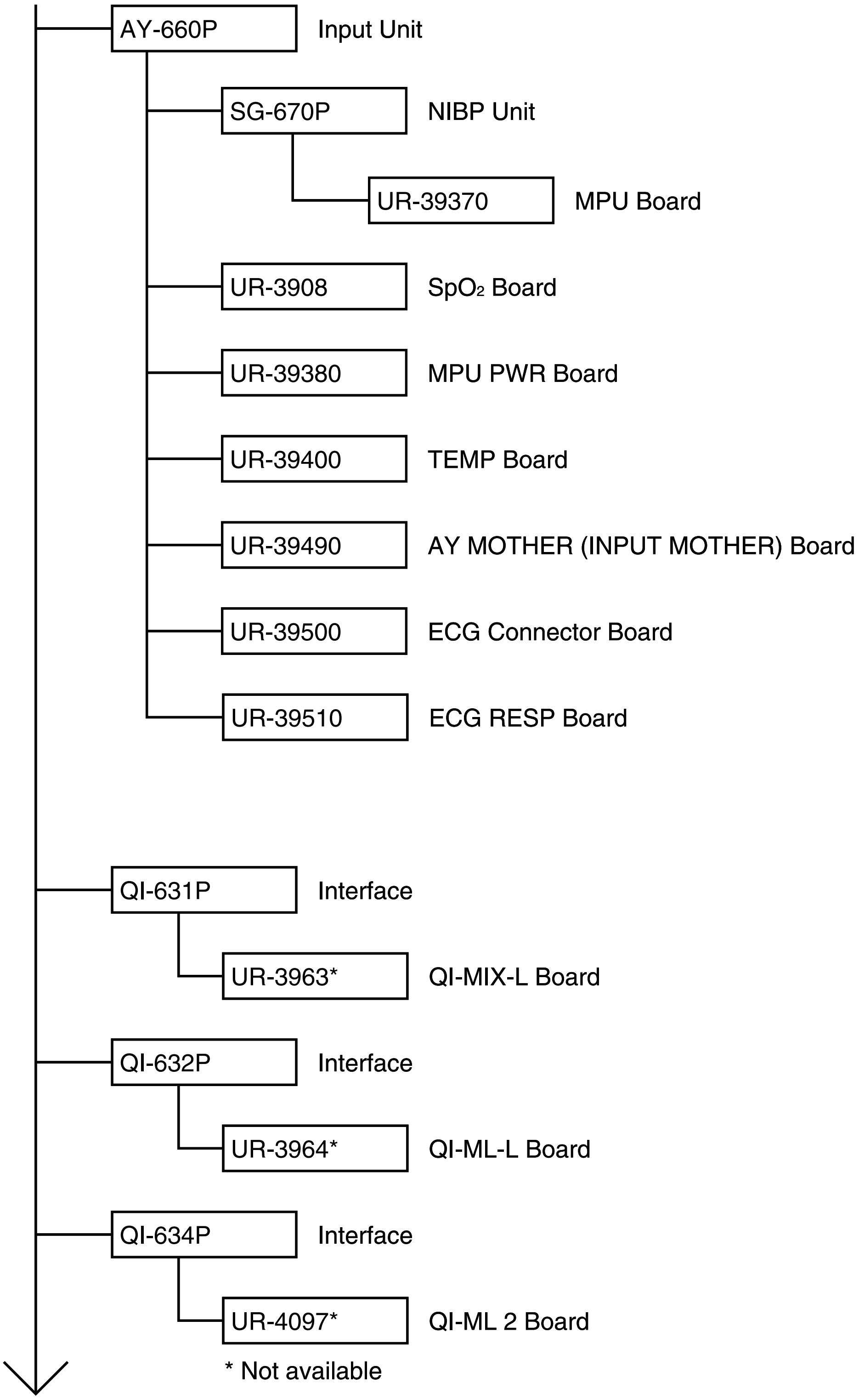
ECG Connector Board
UR-3951
ECG RESP Board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Input Unit
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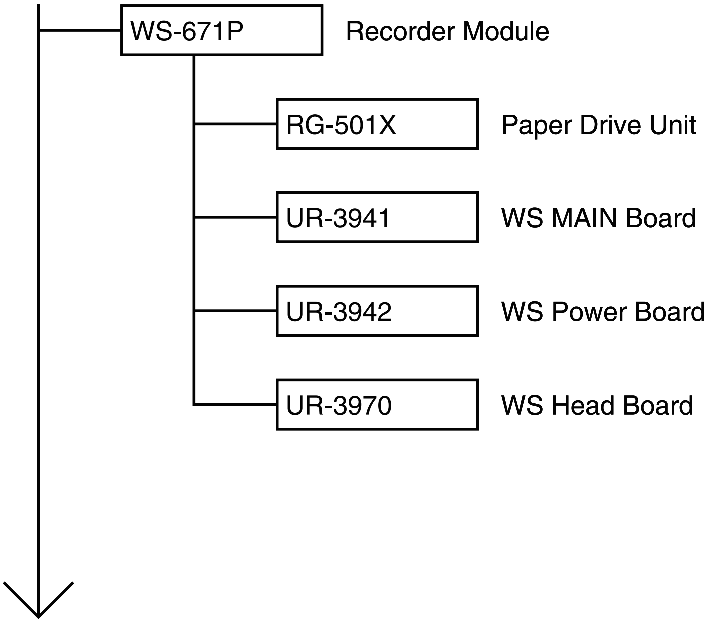
NIBP Unit
UR-39370
MPU Board
UR-3908
SpO2 Board
UR-39380
MPU PWR Board
UR-39400
TEMP Board
UR-39490
AY MOTHER (INPUT MOTHER) Board
UR-39500
ECG Connector Board
UR-39510
ECG RESP Board
QI-631P
Interface
UR-3963*
QI-MIX-L Board
QI-632P
Interface
UR-3964*
QI-ML-L Board
QI-634P
Interface
UR-4097*
QI-ML 2 Board

* Not available


WS-671P
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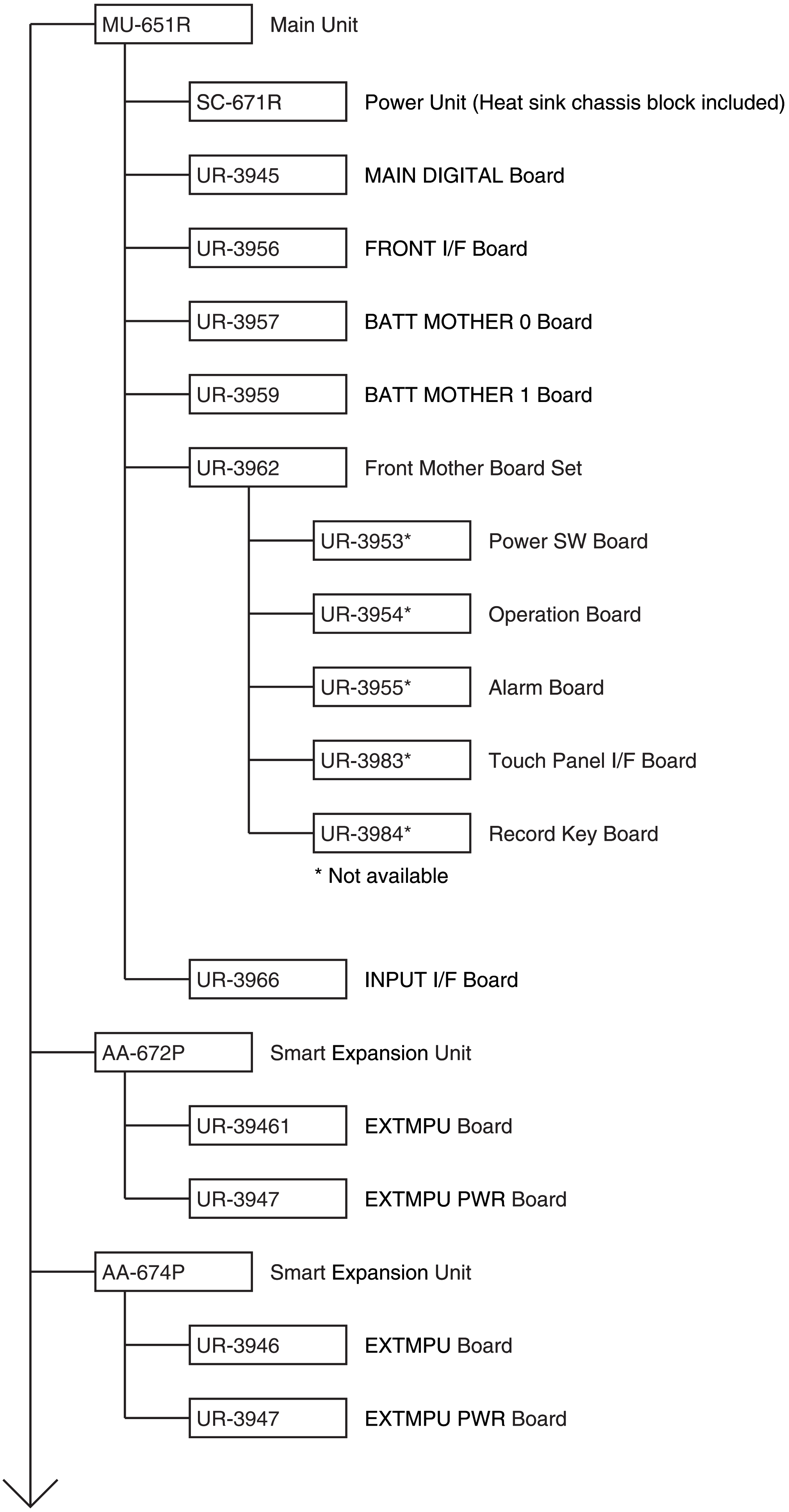
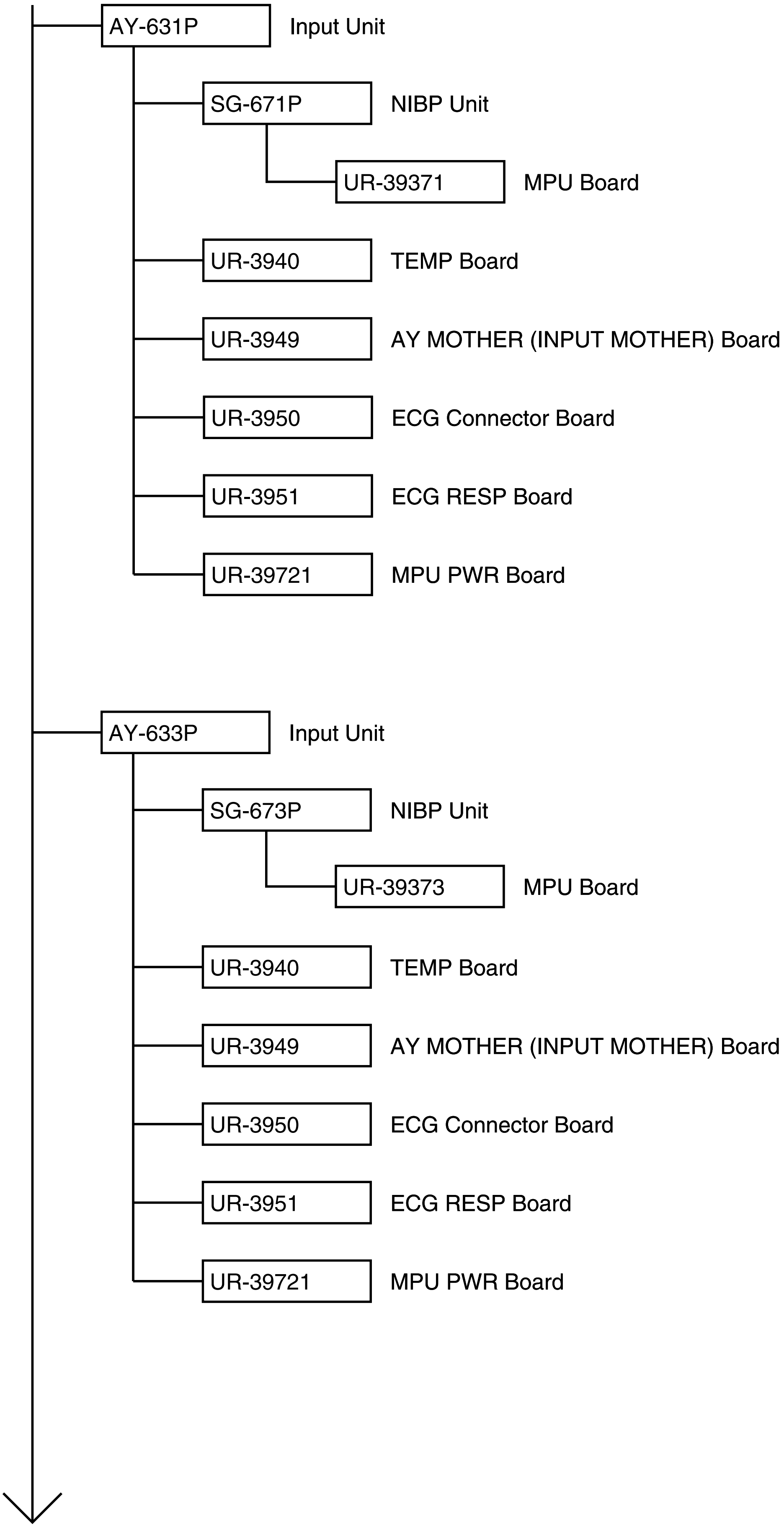
RG-501X
Paper Drive Unit
UR-3941
WS MAIN Board
UR-3942
WS Power Board
UR-3970
WS Head Board

BSM-6501



- MU-651R Main Unit
  - SC-671R Power Unit (Heat sink chassis block included)
  - UR-3945 MAIN DIGITAL Board
  - UR-3956 FRONT I/F Board
  - UR-3957 BATT MOTHER 0 Board
  - UR-3959 BATT MOTHER 1 Board
  - UR-3962 Front Mother Board Set
    - UR-3953* Power SW Board
    - UR-3954* Operation Board
    - UR-3955* Alarm Board
    - UR-3983* Touch Panel I/F Board
    - UR-3984* Record Key Board

    * Not available
  - UR-3966 INPUT I/F Board
- AA-672P Smart Expansion Unit
  - UR-39461 EXTMPU Board
  - UR-3947 EXTMPU PWR Board
- AA-674P Smart Expansion Unit
  - UR-3946 EXTMPU Board
  - UR-3947 EXTMPU PWR Board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TEMP Board
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ECG Connector Board
UR-3951
ECG RESP Board
UR-39721
MPU PWR Board
AY-633P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
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TEMP Board
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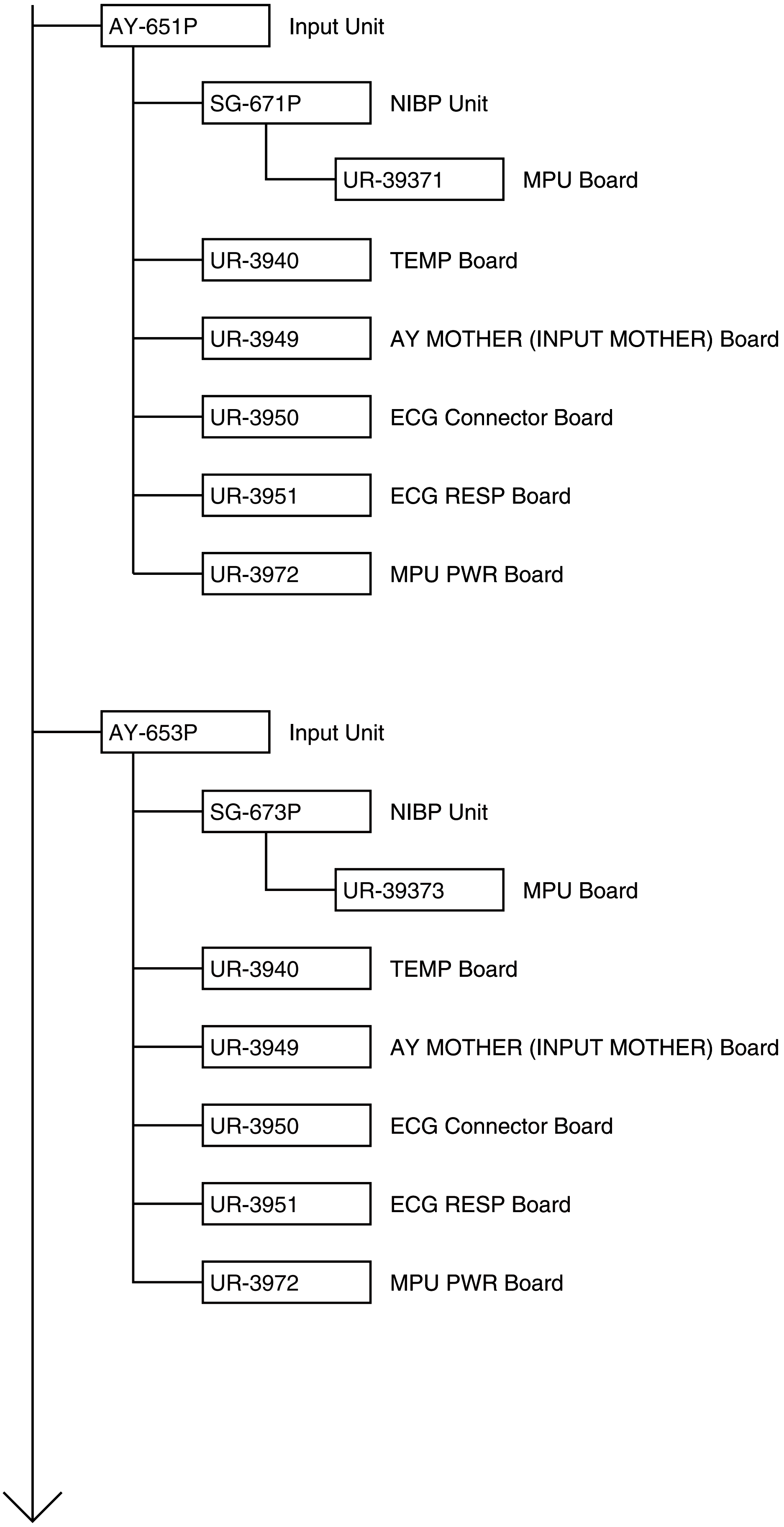
ECG RESP Board
UR-39721
MPU PWR Board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TEMP Board
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UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
UR-3972
MPU PWR Board
AY-653P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3940
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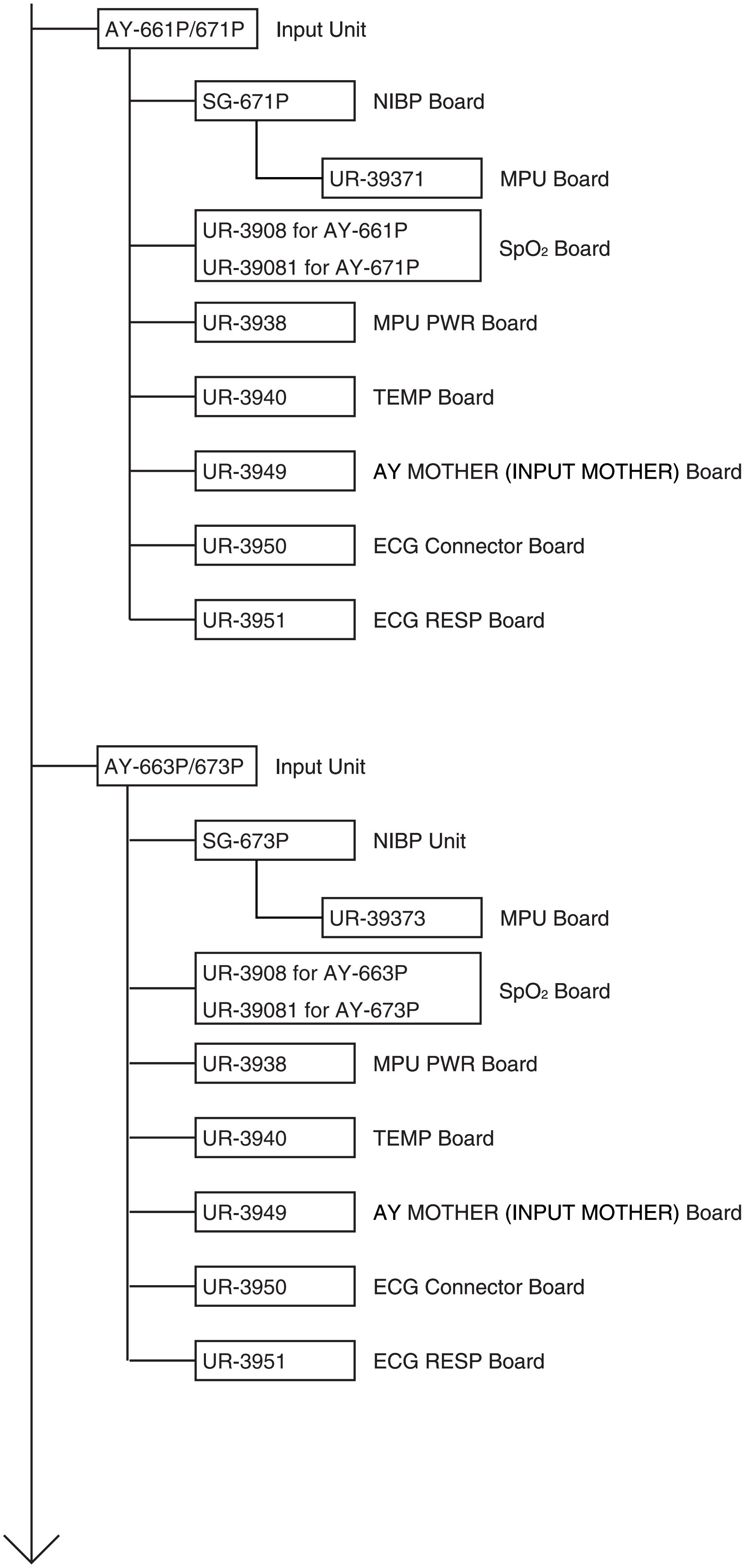
ECG RESP Board
UR-3972
MPU PWR Board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SG-671P
NIBP Board
UR-39371
MPU Board
UR-3908 for AY-661P
UR-39081 for AY-671P
SpO2 Board
UR-3938
MPU PWR Board
UR-3940
TEMP Board
UR-3949
AY MOTHER (INPUT MOTHER) Board
UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
AY-663P/673P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3908 for AY-663P
UR-39081 for AY-673P
SpO2 Board
UR-3938
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TEMP Board
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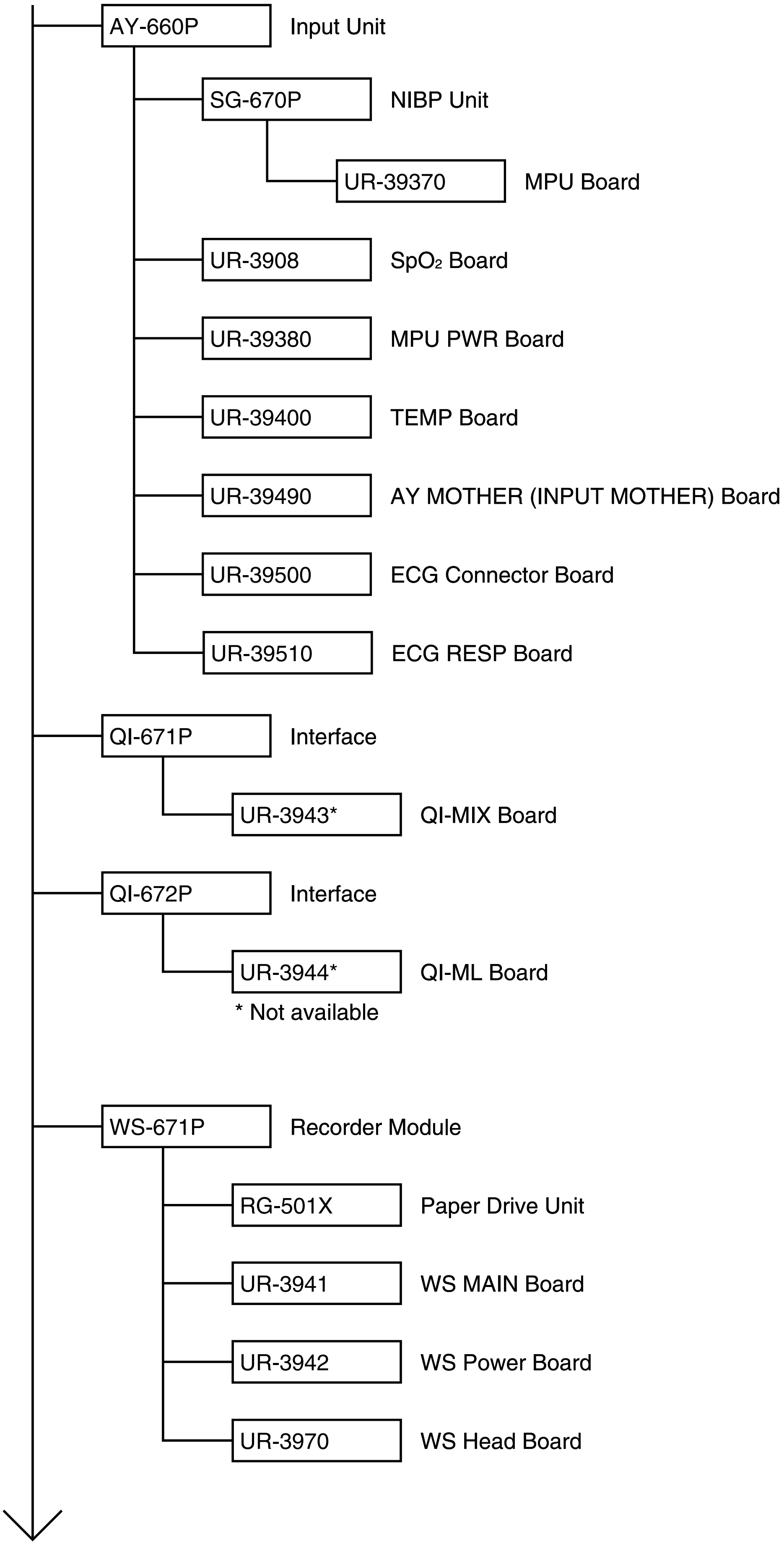
ECG Connector Board
UR-3951
ECG RESP Board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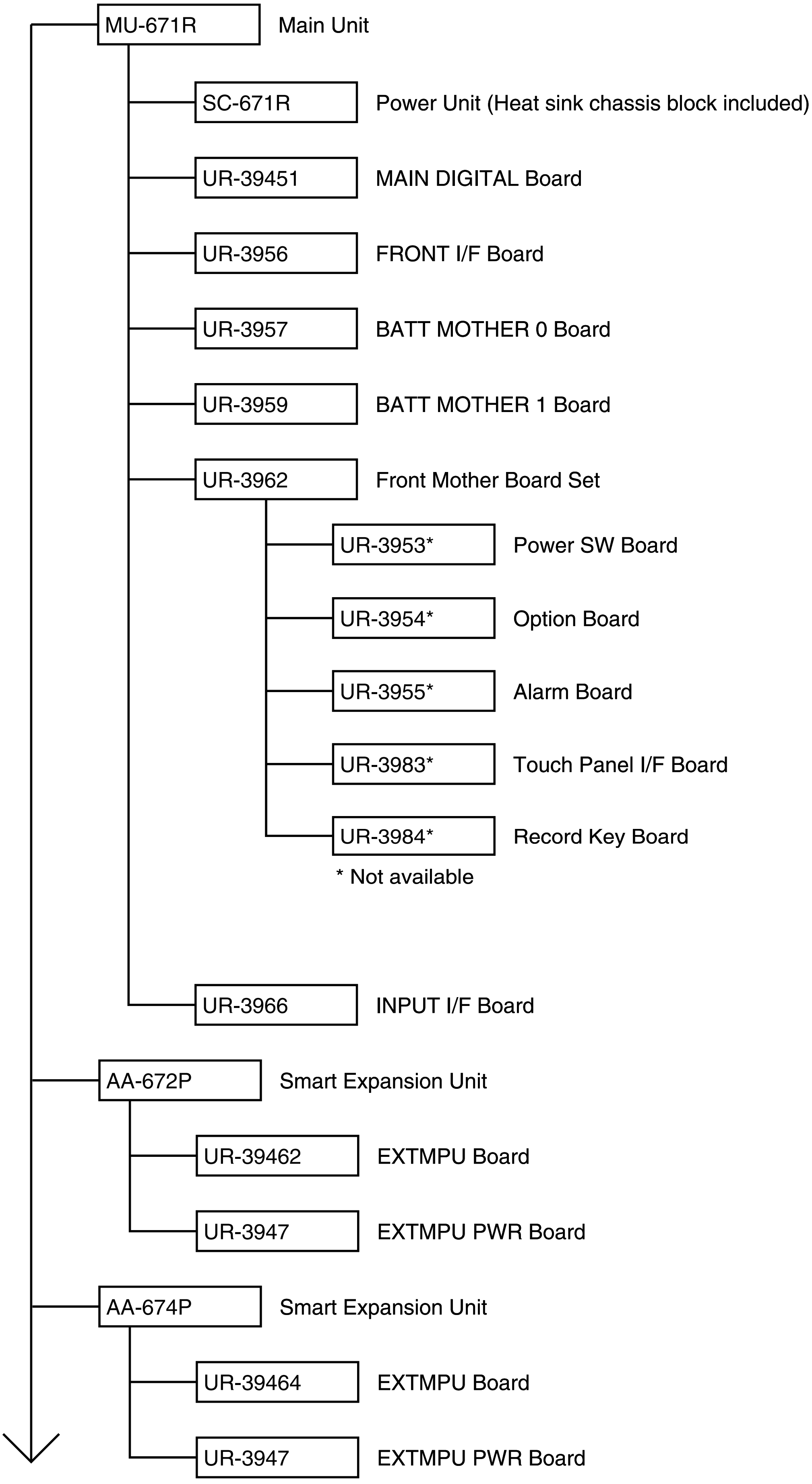
UR-3908 SpO2 Board
UR-39380 MPU PWR Board
UR-39400 TEMP Board
UR-39490 AY MOTHER (INPUT MOTHER) Board
UR-39500 ECG Connector Board
UR-39510 ECG RESP Board
QI-671P Interface
UR-3943* QI-MIX Board
QI-672P Interface
UR-3944* QI-ML Board
* Not available
WS-671P Recorder Module
RG-501X Paper Drive Unit
UR-3941 WS MAIN Board
UR-3942 WS Power Board
UR-3970 WS Head Board

BSM-6701


MU-671R Main Unit
SC-671R Power Unit (Heat sink chassis block included)
UR-39451 MAIN DIGITAL Board
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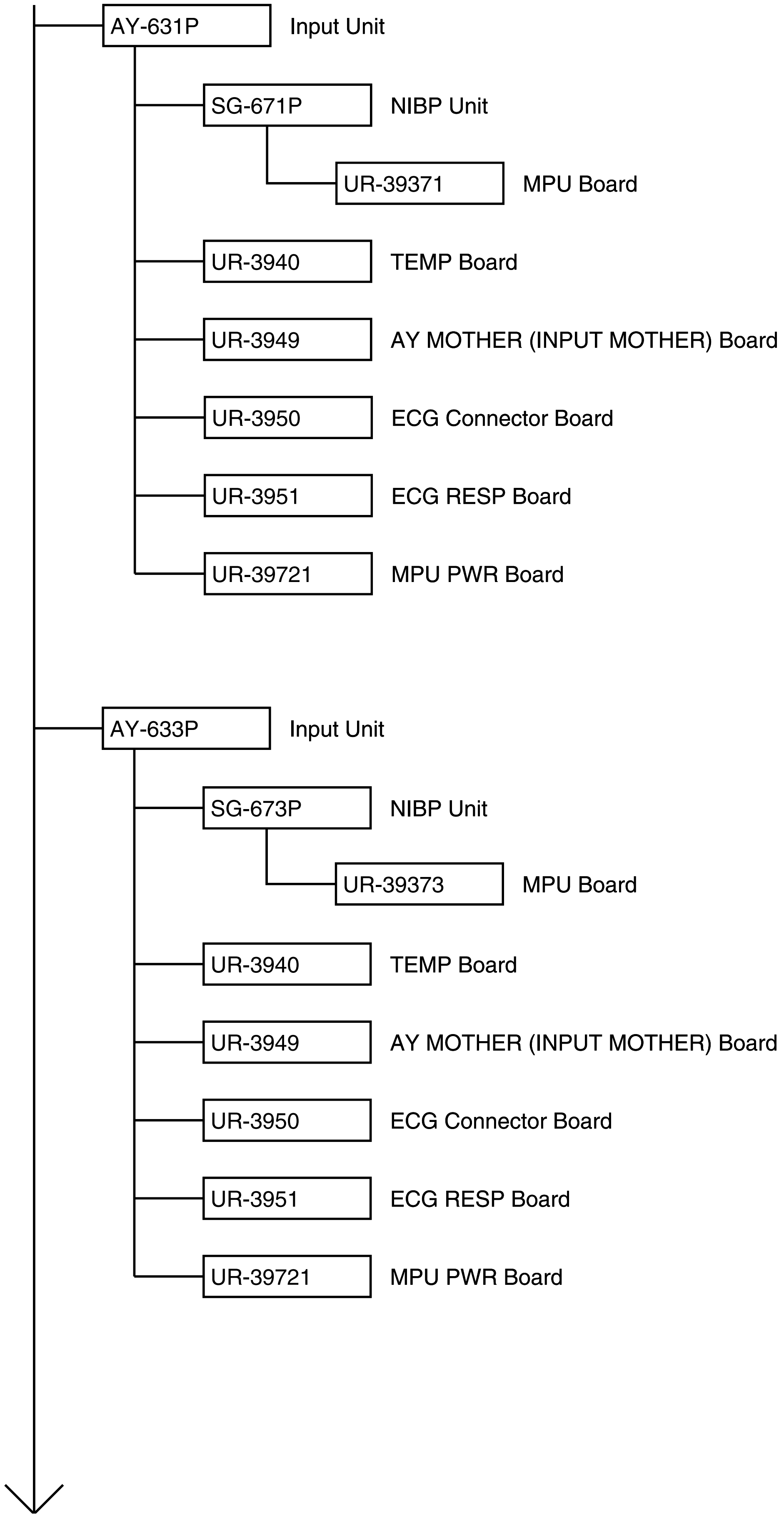
UR-3957 BATT MOTHER 0 Board
UR-3959 BATT MOTHER 1 Board
UR-3962 Front Mother Board Set
UR-3953* Power SW Board
UR-3954* Option Board
UR-3955* Alarm Board
UR-3983* Touch Panel I/F Board
UR-3984* Record Key Board
* Not available
UR-3966 INPUT I/F Board
AA-672P Smart Expansion Unit
UR-39462 EXTMPU Board
UR-3947 EXTMPU PWR Board
AA-674P Smart Expansion Unit
UR-39464 EXTMPU Board
UR-3947 EXTMPU PWR Board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UR-39721
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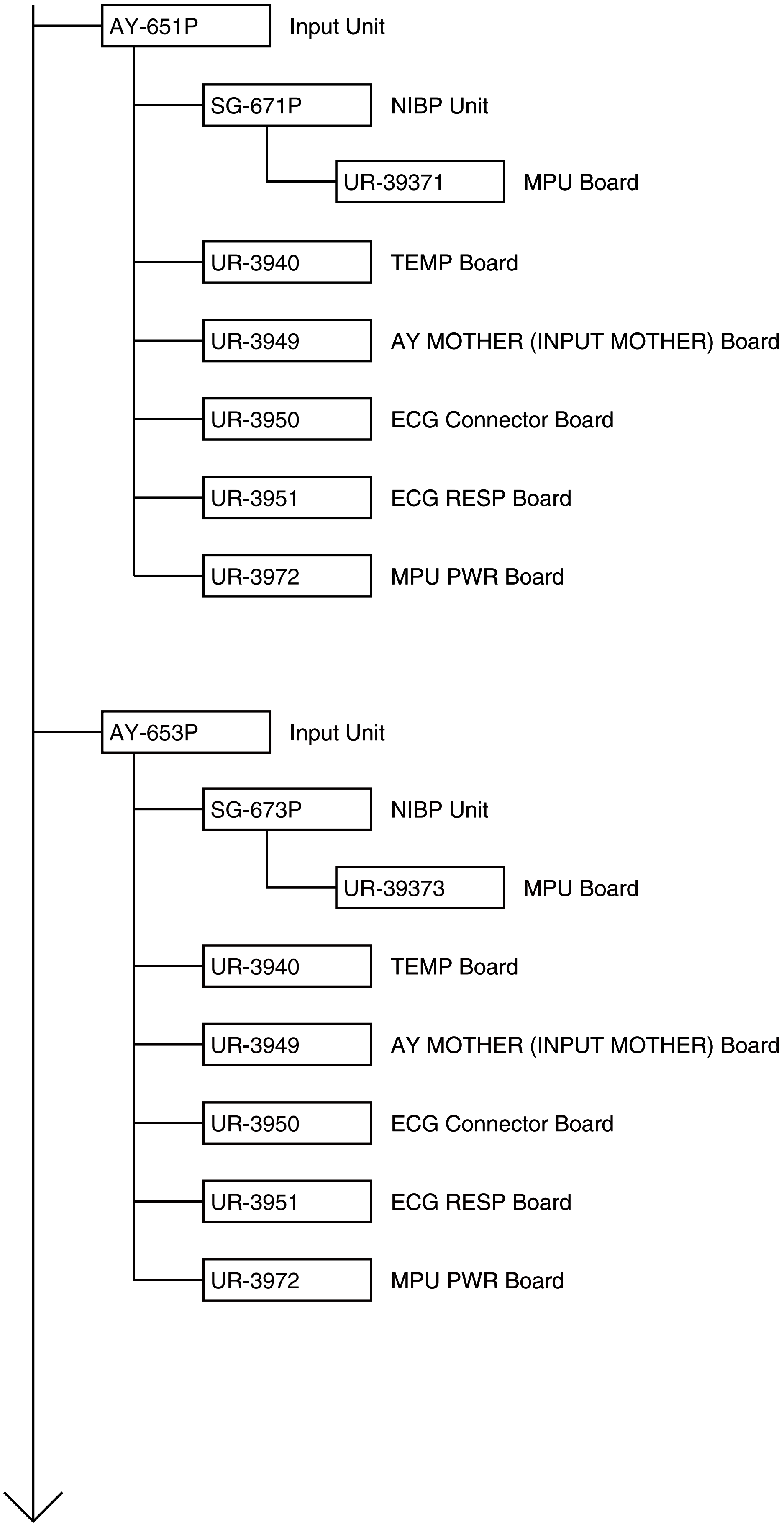
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ECG Connector Board
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ECG RESP Board
UR-3972
MPU PWR Board
AY-653P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3940
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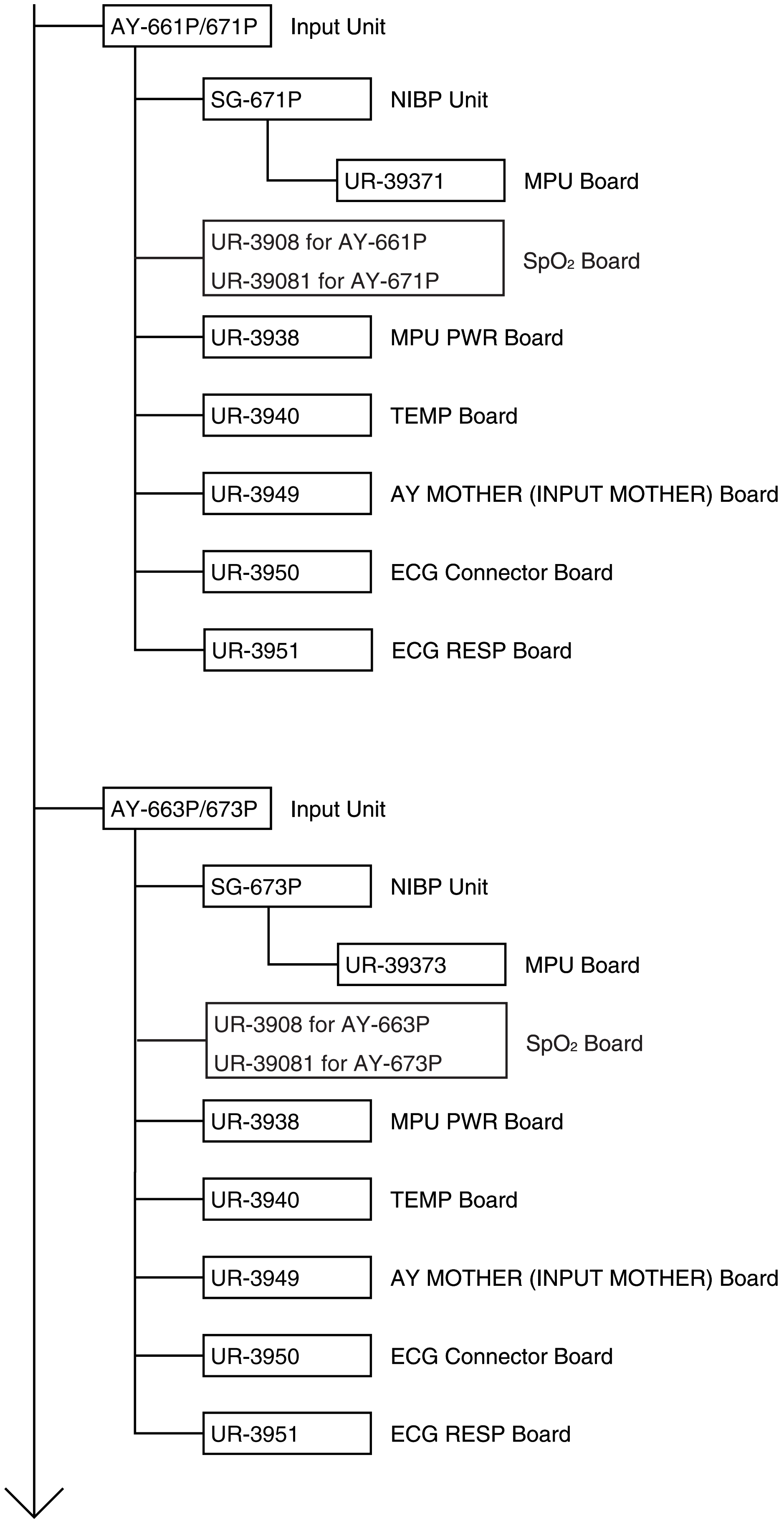
ECG RESP Board
UR-3972
MPU PWR Board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UR-39081 for AY-671P
SpO2 Board
UR-3938
MPU PWR Board
UR-3940
TEMP Board
UR-3949
AY MOTHER (INPUT MOTHER) Board
UR-3950
ECG Connector Board
UR-3951
ECG RESP Board
AY-663P/673P
Input Unit
SG-673P
NIBP Unit
UR-39373
MPU Board
UR-3908 for AY-663P
UR-39081 for AY-673P
SpO2 Board
UR-3938
MPU PWR Board
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ECG Connector Board
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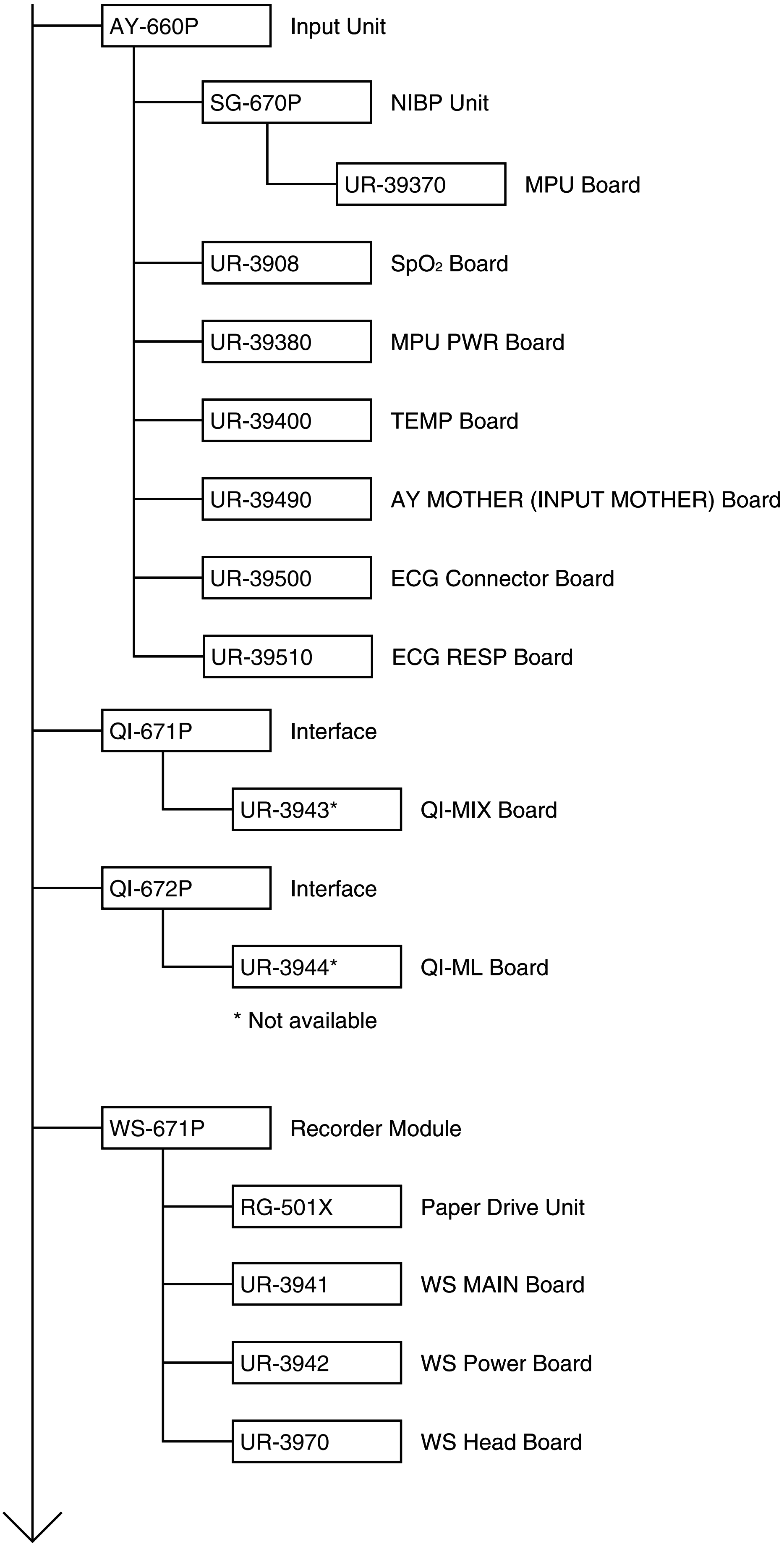
ECG RESP Board


AY-660P
Input Unit
SG-670P
NIBP Unit
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MPU Board
UR-3908
SpO2 Board
UR-39380
MPU PWR Board
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TEMP Board
UR-39490
AY MOTHER (INPUT MOTHER) Board
UR-39500
ECG Connector Board
UR-39510
ECG RESP Board
QI-671P
Interface
UR-3943*
QI-MIX Board
QI-672P
Interface
UR-3944*
QI-ML Board
* Not available
WS-671P
Recorder Module
RG-501X
Paper Drive Unit
UR-3941
WS MAIN Board
UR-3942
WS Power Board
UR-3970
WS Head Board

Software Composition

The software composition is described below.

MU-631P/651P/671P

Type	Board Name	Software Name (displayed on screen)	Remark
UR-3945 (UR-39450) (UR-39451)	MAIN DIGITAL board	IPL	Boot program
		CPU	Main program
		LANG	Language
		ARR*	Arrhythmia analysis
		NIBP*	NIBP measurement
		ECAPS*	12 lead analysis

* For this software, the version number is not displayed on the DIAGNOSTIC CHECK screen. It can be checked on the INFO page of the INFO window in the SYSTEM SETUP window.

WS-671P

Type	Board Name	Software Name (displayed on screen)	Remark
UR-3941	WS MAIN board	RPU*	Recorder

* This software is displayed as “WS” on the DIAGNOSTIC CHECK screen.

AY-631P/633P/651P/653P/660P/661P/663P/671P/673P

Type	Board Name	Software Name (displayed on screen)	Remark
UR-3951	ECG RESP board	EPU	ECG control program
UR-39370/39371/39373	MPU board	DPU0	MPU control program
UR-3908 (UR-39081)*[1]	SpO_2 board	SpO2*[2]	SpO_2 control program

*[1] This board is mounted on AY-660P/661P/663P/671P/673P only.

*[2] For this software, the version number is not displayed on the DIAGNOSTIC CHECK screen. It can be checked on the INFO page of the INFO window in the SYSTEM SETUP window.

AA-672P/674P

Type	Board Name	Software Name (displayed on screen)	Remark
UR-39462/39464	EXTMPU board	DPU1	MPU control program

Specifications

Measuring Parameters

ECG, respiration in impedance and thermistor method, SpO_2, NIBP, IBP, temperature, cardiac output, O_2, CO_2 in mainstream method and sidestream method, flow/Paw, BIS, anesthetic gas (CO_2, O_2, N_2O, agent), TOF, ventilation, CCO, EEG, $tcPO_2$, $tcPCO_2$

Influence on Measuring Accuracy by Electrosurgery/Defibrillation/Electrostatic Discharge

The bedside monitor returns to the previous operating mode within 10 seconds without loss of any stored data. When performing defibrillation, the filter setting on the bedside monitor must be set to MONITOR on the ECG window to return to the previous operating mode within 10 seconds without loss of any stored data. Measurement accuracy may be temporarily decreased while performing electro-surgery or defibrillation. This does not affect patient or equipment safety.

Display

- Display size:
  - BSM-6301: 10.4 inch, color TFT type LCD
  - BSM-6501: 12.1 inch, color TFT type LCD
  - BSM-6701: 15 inch, color TFT type LCD
- Resolution:
  - BSM-6301/6501: 800 × 600 dots
  - BSM-6701: 1024 × 768 dots
- Viewing area:
  - BSM-6301: 212.2 mm × 159.4 mm
  - BSM-6501: 246.0 mm × 184.5 mm
  - BSM-6701: 304.1 mm × 228.1 mm
- Waveform display: ECG (maximum 12 traces), respiration, IBP (maximum 7 traces), SpO_2 pulse wave, CO_2 and CO thermodilution curve, EEG, N_2O concentration, O_2 concentration, anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), flow, Paw, volume
- Waveform display mode: Non-fade moving or non-fade fixed
- Maximum number of waveform trace: 15 traces
- Sweep speed: 6.25, 12.5, 25 or 50 mm/s
- Respiration sweep speed: 1.56, 6.25, 12.5 or 25 mm/s
- Aspect ratio (ECG display sensitivity ratio to sweep speed):
  - Standard: 0.4 s/mV
  - Setting range: 0.05 to 6.4 s/mV
- Sweep time (at 25 mm/s sweep speed):
  - BSM-6301: 6.0 s
  - BSM-6501: 6.5 s
  - BSM-6701: 9.5 s
- Display delay time:
  - DIAG and MONITOR mode: ≤ 250 ms
  - MAXIMUM mode: ≤ 1 s
- Waveform display color: 12 colors
- Numeric data display: Heart rate, VPC rate, ST level, respiration rate, NIBP (systolic, diastolic, MAP), PWTT, delta PWTT, IBP (systolic, diastolic, mean), SpO_2, pulse rate, temperature, cardiac output, cardiac index, injectate temperature, blood temperature, O_2 concentration, $ETCO_2$, $FiCO_2$, BIS, inspired/expired N_2O

	concentration, inspired/expired O_2 concentration, inspired/expired anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), minimum alveolar concentration, peak airway pressure, positive end expiratory pressure, mean airway pressure, minute volume, expiratory/inspiratory tidal volume, compliance, airway resistance, expiratory/inspiratory airway resistance, inspiration expiration ratio, inspired setO_2, CCO, SVRI, $S\bar{v}O_2$, Tb, EF, $Sc\bar{v}O_2$, CCI, EDV, SVR, EDVI, PCCO, PCCI, SEF, MDF, PPF, TP, Abs δ, Abs θ, Abs α, Abs β, Abs γ, % δ, % θ, % α, % β, % γ, $tcPO_2$, $tcPCO_2$, PPV, SPV
Synchronization mark:	Heart rate sync mark, pulse rate sync mark, respiratory sync mark
Numeric display color:	12 colors
Recovery time after defibrillation:	$\leq$ 10 s (at MONITOR mode)

Alarm

Alarm levels:	
Crisis:	Patient is in critical condition and the patient's life may be at risk. Immediate action must be taken.
Warning:	Patient is in critical condition. Prompt action should be taken.
Advisory:	Setting or condition is not appropriate for accurate monitoring.
Alarm items:	
Vital sign alarms:	HR, PR, ST, RR, APNEA, TEMP, delta TEMP, SpO_2, SpO_2-2, delta SpO_2, NIBP, IBP, $ETCO_2$, CO_2 (I), O_2 (I), O_2 (E), Tb, MV, Ppeak, PEEP, N_2O (I), N_2O (E), Agent (I), Agent (E), SEF, BIS
Arrhythmia alarms:	ASYSTOLE, VF, VT, V BRADY, EXT TACHY, EXT BRADY, SV TACHY, VPC RUN, TACHYCARDIA, BRADYCARDIA, COUPLET, EARLY VPC, MULTIFORM, V RHYTHM, PAUSE, BIGEMINY, TRIGEMINY, VPC, IRREGULAR RR, PACER NON-CAPTURE, PROLONGED RR, NO PACER PULSE
Interbed alarms	
Technical alarms:	Alarms concerning instrument and measuring environment such as, connector disconnection alarm, noise alarm, electrode off alarm, waveform detecting alarm, probe off alarm, cuff/hose check alarm, sensor check alarm, low battery alarm, etc.
Alarm indication*:	Alarm sound, blinking/lighting alarm indicator, highlighted numeric data/message. Displays the alarmed item at the upper part of the screen.* * Essential performance in EMC standard
Alarm indicator:	
Crisis:	red blinking: approx. 1.6 Hz (approx. 640 ms), duty 50%
Warning:	yellow blinking: approx. 0.8 Hz (approx. 1280 ms), duty 50%
Advisory:	yellow or cyan lighting
Alarm sound:	
Crisis:	NK1 (Continuous pip sound), NK2 (Continuous ping sound) or IEC standard
Warning:	NK1 (Continuous bing bong sound), NK2 (Continuous ding ding sound) or IEC standard
Advisory:	NK1 and NK2 (Single beep every 20 or 120 seconds) or IEC standard
Alarm silence:	Provided for 1, 2 or 3 min. When another alarm occurs during alarm silence, alarm is indicated
Alarm suspend:	Provided for 1, 2, 3 min or OFF
All alarms off:	Provided

Alarm volume:

Volume range: 45 to 85 dB (A) (Requirement of IEC 60601-2-49: 2001) (at 1 m in front of monitor)

Volume priority: Crisis ≥ Warning ≥ Advisory

Alarm Delay Time

Includes time to output alarm from the network socket on the monitor when connected to the network.

Includes time to output alarm from the transmitter when the ZS-900P transmitter is connected.

Heart rate: HR change from 80 to 120 bpm ≤ 10 seconds (upper limit: 100 bpm)
HR change from 80 to 40 bpm ≤ 10 seconds (lower limit: 60 bpm)

Time to alarm for tachycardia: Ventricular tachycardia (amplitude 1 mV p-v, heart rate 206 bpm):
at ×1 gain (Test waveform name: aami4a*): 4 to 10 seconds
at ×0.5 gain (Test waveform name: aami4a_h*): 4 to 10 seconds
at ×2 gain (Test waveform name: aami4a_d*): 4 to 10 seconds
Ventricular tachycardia (amplitude 2 mV p-v, heart rate 195 bpm):
at ×1 gain (Test waveform name: aami4b*): 4 to 10 seconds
at ×0.5 gain (Test waveform name: aami4b_h*): 4 to 10 seconds
at ×2 gain (Test waveform name: aami4b_d*): 4 to 10 seconds
* The test waveforms can be downloaded at http://www.physionet.org

Pulse rate: PR change from 80 to 120 bpm ≤ 35 seconds (upper limit: 100 bpm)
PR change from 80 to 40 bpm ≤ 35 seconds (lower limit: 60 bpm)

ST: Approx. 1 second after measurement value reaches alarm threshold (averaged 15-second data)

Respiration rate: Approx. 5 seconds after measurement value reaches alarm threshold (with 8 respiration intervals)

NIBP: Approx. 1 seconds after measurement value becomes stable

IBP: IBP change from 100 to 60 mmHg ≤ 15 seconds (at pulse rate 80 bpm, SYS lower limit: 80 mmHg)

SpO_2: Approx. 5 seconds after measurement value reaches alarm threshold

Temperature: Approx. 1 second after measurement value reaches alarm threshold

Blood temperature: Approx. 1 second after measurement value reaches alarm threshold
For catheter response time, refer to the manual for the catheter.

O_2 (when JO-900P FiO_2 connection cord is used):
Approx. 1 second after measurement value reaches alarm threshold
Sensor response time (90%): Maximum 15 seconds

CO_2 (Mainstream and sidestream method): Approx. 5 seconds after measurement value reaches alarm threshold (when the next respiration is detected)

Gas (CO_2, N_2O, O_2, anesthetic agent): Approx. 5 seconds after measurement value reaches alarm threshold (when the next respiration is detected)

MV (FLOW): Approx. 5 seconds after measurement value reaches alarm threshold (Integrated data from 8 respiration intervals and TV (tidal volume))

Ppeak, PEEP (FLOW): Approx. 5 seconds after measurement value reaches alarm threshold (when the next respiration is detected)

BIS: Approx. 1 second after measurement value reaches alarm threshold

SEF, TP (EEG): Approx. 1 second after measurement value reaches alarm threshold

Alarm signal delay in central monitor network: ≤ 4 s

ECG

Complies with IEC 60601-2-27 1st edition: 1994, 2nd edition: 2005, ANSI/AAMI EC13: 2002, ANSI/AAMI EC57: 1998.

Leads:

3-electrode cable:	I, II, III	
6-electrode cable:	I, II, III, aVR, aVL, aVF, 2 from V1 to V6	
10-electrode cable:	I, II, III, aVR, aVL, aVF, V1 to V6	
Defibrillation-proof:	ECG input protected against 400 Ws/DC 5 kV IEC 60601-2-27 17.101 compatible	
Electrode offset potential tolerance:	≥ ±500 mV	
Input dynamic range:	≥ ±5 mV	
Internal noise:	≤ 30 μVp-p (Referred to input)	
Noise suppression:		
RL driving gain:	maximum 40 dB	
Maximum voltage:	1.23 Vrms	
Common mode rejection ratio:	≥ 95 dB	
Input bias current:	≤ 100 nA	
Frequency response:		
DIAG mode:	0.05 to 150 Hz (–3 dB)	
MONITOR mode:	0.3 to 40 Hz (–3 dB)	
MAXIMUM mode:	1 to 18 Hz (–3 dB)	
Input impedance:	≥ 5 MΩ (at 10 Hz) ≥ 2.5 MΩ (at 0.67 to 40 Hz)	
ESU protection:	Provided, recovers within 10 seconds after ESU and acquired data is not lost. IEC 60601-2-27: 2005 compatible	
Leads-off sensing:	Each leads has own sensing	
Active electrode:	< 100 nA	
Reference electrode:	< 900 nA	
12 lead ECG interpretation:	ECAPS 12C (BSM) Available when monitoring 12 leads	
Time constant (at 10 Hz):	3.2 s 0.05 to 150 Hz ±10 Hz (≥ –3 dB)	
AC hum filter:	≤ –40 dB (at 50 or 60 Hz)	
Interpretation items:	Normal sinus rhythm, TACHYCARDIA, BRADYCARDIA, VPC RUN, COUPLET, EARLY VPC	
Display and output:	Screen, recorder module, network printer, printer connected to the central monitor	
File storage:	6 files	
Waveform display:		
Display sensitivity:	10 mm/mV ±5% (at ×1 sensitivity)	
Number of channels:	3 (maximum, with 6 or 10 electrodes on home screen) 12 (maximum, with 10 electrodes at 12 LEAD window)	
Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4, or AUTO	
Pacing mark display:	Available	
Recording sensitivity:	10 mm/mV ±5% (same as the display sensitivity)	
Heart rate count:		
Calculation method:	Moving average/Instantaneous beat to beat	
QRS detection (at × 1 sensitivity):	Adult:	Width: 70 to 120 ms Amplitude: ≥ 0.5 mV, rate: 30 to 200 beats/min
	Child and neonate:	Width: 40 to 120 ms Amplitude: ≥ 0.5 mV, rate: 30 to 250 beats/min
Counting range:	0, 15 to 300 beats/min (±2 beats/min)	
Counting accuracy*:	±2 beats/min (0, 15 to 300 beats/min)	

* Essential performance in EMC standard

Heart rate display update cycle: Every 3 s or when alarm is generated

Heart rate sync mark delay time: within 100 to 200 ms (when QRS is detected)

Tall T-wave rejection capability: Complies with the heights of T-waves from 0 mV to 1.2 mV specified in ANSI/AAMI EC13 Sect. 4.1.2.1(c)

Heart rate averaging: Calculated by using the most recent 4 or 12 beats.

Heart rate meter accuracy and response to irregular rhythm:

Ventricular bigeminy (Test waveform name: aami3a*): 80 bpm

Slow alternating ventricular bigeminy (Test waveform name: aami3b*): 60 bpm

Rapid alternating ventricular bigeminy (Test waveform name: aami3c*): 120 bpm

Bidirectional systoles (Test waveform name: aami3d*): 90 bpm

* The test waveforms can be download at http://www.physionet.org

Response time of heart rate meter to change in heart rate:

HR change from 80 to 120 bpm: 9 to 12 seconds

HR change from 80 to 40 bpm: 9 to 13 seconds

Time to alarm for tachycardia: Ventricular tachycardia (amplitude 1 mV p-v, heart rate 206 bpm):

at ×1 gain (Test waveform name: aami4a*): 4 to 10 seconds

at ×0.5 gain (Test waveform name: aami4a_h*): 4 to 10 seconds

at ×2 gain (Test waveform name: aami4a_d*): 4 to 10 seconds

Ventricular tachycardia (amplitude 2 mV p-v, heart rate 195 bpm):

at ×1 gain (Test waveform name: aami4b*): 4 to 10 seconds

at ×0.5 gain (Test waveform name: aami4b_h*): 4 to 10 seconds

at ×2 gain (Test waveform name: aami4b_d*): 4 to 10 seconds

* The test waveforms can be download at http://www.physionet.org

Pacemaker pulse detector rejection of fast ECG signals:

Slew rate at which the pacemaker pulse detector responds: 6 to 8 V/s

Tested as specified in ANSI/AAMI EC13 Sect. 4.1.4.3

Pacemaker pulse rejection capability, without overshoot:

Complies with the amplitudes of pacemaker pulses ±2 to ±700 mV and widths 0.1 to 2 ms specified in ANSI/AAMI EC13 Sect. 4.1.4.1

Pacemaker pulse rejection capability, with overshoot:

Overshoot amplitudes and time constants of ±0.12 mV/100 ms to ±2 mV/4 ms (As defined by method B of ANSI/AAMI EC13 Sect. 4.1.4.2, this corresponds to the pacemaker pulses amplitudes and widths of ±4 mV/2 ms to amplitudes ±80 mV/0.1 ms.)

Heart rate alarm: Upper limit range: 16 to 300 beats/min, OFF in 1 beat/min steps

Lower limit range: OFF, 15 to 299 beats/min in 1 beat/min steps

Alarm items: TACHYCARDIA, BRADYCARDIA

Arrhythmia analysis:

Analysis method: Multi-template matching method

Number of channels: 2

VPC counting rate: 0 to 99 VPCs/min

Arrhythmia message: ASYSTOLE, VF, VT, V BRADY, EXT TACHY, EXT BRADY, SV TACHY, VPC RUN, TACHYCARDIA, BRADYCARDIA, COUPLET, EARLY VPC, MULTIFORM, V RHYTHM, PAUSE, BIGEMINY, TRIGEMINY, VPC, IRREGULAR RR, PACER NON-CAPTURE, PROLONGED RR, NO PACER PULSE

Other messages: NOISE, CHECK ELECTRODES, LEARNING

Arrhythmia alarm: Upper limit range: OFF, 1 to 99 VPC/min
Number of arrhythmia recall files: 8,192 (24 hours)
Storage time per file: 8 s
ST level measurement:
Number of measurement channels: 3-electrode: 1 ch
6-electrode: 8 ch
10-electrode: 12 ch
ST level measuring range: ±2.5 mV
Measurement point: Manual
ST level alarm: Upper limit range: –1.99 to 2.00 mV in 0.01 mV steps, OFF
Lower limit range: OFF, –2.00 to 1.99 mV in 0.01 mV steps
Number of ST recall files: 1,440 files

Respiration (Transthoracic impedance pneumography)

Measuring method: Transthoracic impedance pneumography
Number of channels: Selectable from R-F and R-L
Measuring impedance available range: 220 Ω to 4 kΩ
Excitor current: 45 ±10 μArms at 40 kHz (sine wave)
Internal noise: ≤ 0.2 Ω (Referred to input)
Respiration rate counting range: 0 to 150 counts/min
Respiration rate counting accuracy*: ±2 counts/min (0 to 150 counts/min)
* Essential performance in EMC standard
Frequency response (high frequency cut-off):
3 Hz ±1 Hz (–3 dB)
Defibrillation proof: Respiration input protected against 400 Ws/DC 5 kV
Impedance respiration: Measurement On/Off available
Heart beat rejection: Available
Waveform display:
Display sensitivity: 10 mm/1 Ω ±25% (at ×1 sensitivity)
Sensitivity control: ×1/4, ×1/2, ×1, ×2, ×4
Respiration rate display update cycle: Every 3 s or when alarm is generated
Alarm: Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF
Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea alarm: OFF, 5 to 40 s in 5 s steps
Displayed message: APNEA

SpO$_2$

Complies with ISO 9919: 2005.
Display:
Display update cycle: Every 3 s or when alarm is generated
Sync tone modulation: Changes tone depending on SpO$_2$ value
Sweep speed: 6.25, 12.5, 25, 50 mm/s
Waveform sensitivity: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO
SpO$_2$:
Measuring method: Two wavelength light absorption method
Wavelength range: AY-631P/AY-633P: 660/905 nm (LNOP tip clip and LNCS tip clip)
663/880 nm (Other clips)
AY-651P/AY-653P: 660/900 nm
Emitted light energy: AY-631P/AY-633P: 0.13 mW minimum, 0.79 mW maximum

	AY-651P/AY-653P:	< 15 mW
Data delay time:		≤ 10 s
Averaging time:	AY-651P/AY-653P:	6 to 7 s (approximately 3 seconds in FAST mode) If the dynamic averaging time exceeds 20 seconds for SpO_2, the SpO_2 and pulse rate will continue to be updated every second.
Display range:	AY-631P/AY-633P/AY-651P/AY-653P:	1 to 100%SpO_2
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	0 to 100%SpO_2
Declared range:	AY-631P/AY-633P/AY-651P/AY-653P:	Depends on probe. Refer to the probe manual.
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	70 to 100%SpO_2
Measuring accuracy*:	AY-631P/AY-633P/AY-651P/AY-653P:	Depends on probe. Refer to the probe manual.
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	70%SpO_2 ≤ %SpO_2 ≤ 80%SpO_2 ±3%SpO_2 80%SpO_2 ≤ %SpO_2 ≤ 100%SpO_2 ±2%SpO_2 Accuracy at surrounding temperature: 18 to 40°C (64.4 to 104°F)

* Essential performance in EMC standard

NOTE for SpO_2 Accuracy of AY-660P/AY-661P/AY-663P/AY-671P/AY-673P

- The SpO_2 accuracy was tested on OLV-3100 pulse oximeter using the TL-201T, TL-260T, TL-271T and TL-631T SpO_2 probes. The testing was performed during induced hypoxia on healthy volunteers (Ethnicity: 10 Caucasians, 2 Africans, 1 Asian and 3 Indians), (Skin: 8 Light, 4 Medium, 4 Dark), (Age: 21 to 34), (5 women and 11 men) under the condition of no motion. Arterial blood was sampled and measured by a CO-oximeter. The difference between SpO_2 measured by the SpO_2 probe and functional SaO_2 measured by a CO-oximeter was calculated using the root-mean-square (rms) according to ISO 9919: 2005. This measurement accuracy figure represents 2/3 of all test measurements.
- A pulse oximeter tester that generates simulated signals can be used to check the difference from the design specification, but it cannot be used as a replacement for human signals for testing accuracy.

NOTE for SpO_2 Accuracy of AY-631P/AY-633P/AY-651P/AY-653P

The SpO_2 accuracy has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. Pulse oximeter measurement are statistically distributed, only about two-thirds of the measurements can be expected to fall within the specified accuracy compared to CO-oximeter measurements.

NOTE for AY-631P/AY-633P

The plethysmographic waveform is scaled to a fixed size for signal strengths above 10% or 0.5%.

NOTE for AY-651P/AY-653P

Nellcor OEM modules communicate a non-normalized depiction of the plethysmographic waveform.

SpO$_2$ alarm: Upper limit range: 51 to 100%SpO$_2$ in 1%SpO$_2$ steps, OFF
Lower limit range: OFF, 50 to 99%SpO$_2$ in 1%SpO$_2$ steps

Pulse rate:

Display range:
AY-631P/AY-633P: 25 to 240 beats/min
AY-651P/AY-653P: 20 to 300 beats/min
AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: 30 to 300 beats/min

Declared range:
AY-631P/AY-633P: 25 to 240 beats/min
AY-651P/AY-653P: 20 to 300 beats/min
AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: 30 to 300 beats/min

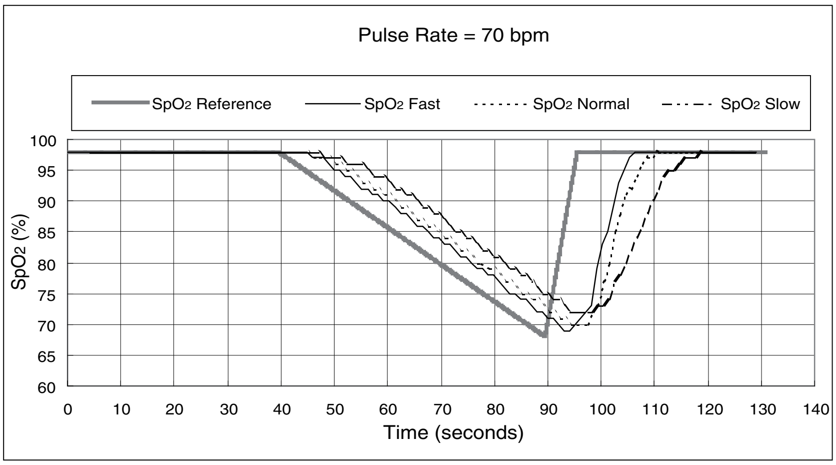
Counting accuracy (rms)*:
AY-631P/AY-633P: ±3 beats/min: No motion
±5 beats/min: Motion
AY-651P/AY-653P: ±3 beats/min
AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: ±3% ±1 beat/min
* Essential performance in EMC standard

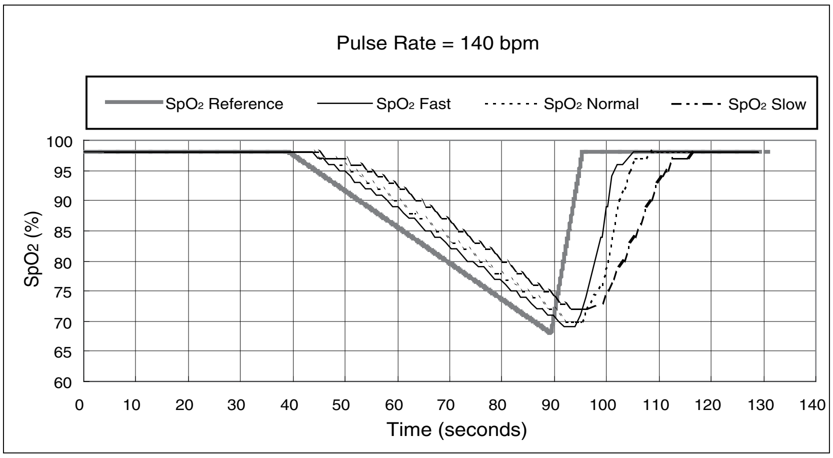
Pulse rate alarm:
Upper limit range: When SYNC SOURCE is set to ECG:
16 to 300 beats/min in 1 beat/min steps, OFF
When SYNC SOURCE is set to PRESS or SpO$_2$:
31 to 300 beats/min in 1 beat/min steps, OFF
Lower limit range: When SYNC SOURCE is set to ECG:
OFF, 15 to 299 beats/min in 1 beat/min steps
When SYNC SOURCE is set to PRESS or SpO$_2$:
OFF, 30 to 299 beats/min in 1 beat/min steps

Response time (AY-660P/AY-661P/AY-663P only):

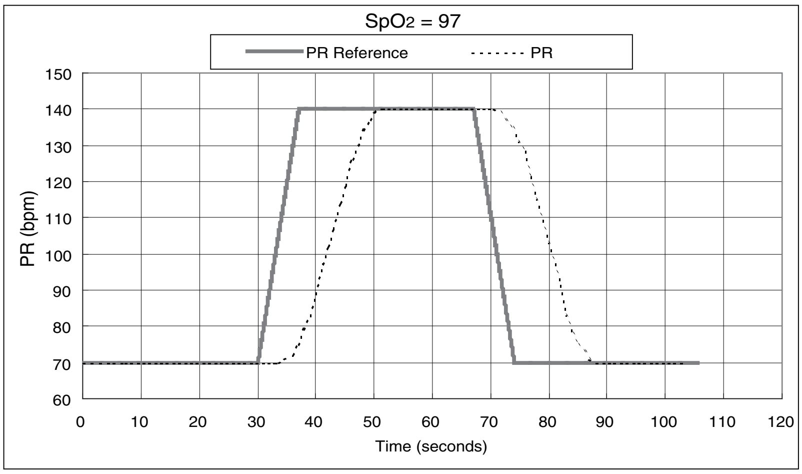
Selectable from “SLOW”, “NORMAL” and “FAST”.

The following graphs show the response time example when SpO$_2$ changes 0.6%/s.





The following graph shows the response time example when pulse rate changes 10 bpm/s.



Non Invasive Blood Pressure, NIBP

Complies with IEC 60601-2-30: 1999.

Measuring method:	Oscillometric
Measuring range:	0 to 300 mmHg
Cuff pressure display range:	0 to 300 mmHg
Accuracy:	±3 mmHg (0 mmHg ≤ NIBP < 200 mmHg) ±4 mmHg (200 mmHg ≤ NIBP ≤ 300 mmHg)
Cuff inflation time:	
Adult/Child:	≤ 7 s (700 cc)
Neonate:	≤ 5 s (72 cc)
Measurement mode:	Adult, child or neonate is recognized by connected air hose
Maximum measurement time:	
Adult/Child:	≤ 160 s
Neonate:	≤ 80 s
Operation mode:	Manual, STAT (≤ 15 min), Periodic, PWTT and SIM (depends on the SITE setting)
Cuff pressure settings:	Manual or Auto
Auto remeasurement:	1 time
Air leakage:	≤ 3 mmHg/min
Measurement accuracy with a simulator*:	±10 mmHg * Essential performance in EMC standard

Initial pressurization value:
Adult: 180 mmHg
Child: 140 mmHg
Neonate: 100 mmHg
Maximum pressurization value:
Adult/Child: 300 mmHg
Neonate: 150 mmHg
Display items: Systolic (SYS), diastolic (DIA), mean (MAP), cuff pressure during NIBP measurement, delta PWTT
NIBP data display update cycle: Updated every measurement
Measurement completion sound: Generated at measurement completion (depends on the setting)
Alarm
Upper limit range: 15 to 260 mmHg in 5 mmHg steps, OFF
Lower limit range: OFF, 10 to 255 mmHg in 5 mmHg steps
Safety
Maximum pressurization value cuff inflation limiter: Adult/Child: 300 to 330 mmHg
Neonate: 150 to 165 mmHg
Cuff inflation time limiter: Adult/Child: 161 to 165 s
Neonate: 81 to 84 s
Interval time limiter: 25 to 29 s
Power discontinuity: Deflate immediately after power down

Multi Socket

Input impedance: ≥ 900 kΩ
Excitor output impedance: ≤ 2 Ω
Excitor overcurrent protection: 100 mA
+5 V maximum power output from the socket: 500 mA

Invasive Blood Pressure, IBP

Complies with IEC 60601-2-34: 2000 except for clauses 44.6, 45.101 a) and 45.101 b).
Complied transducer: P23XL-1 and P10EZ-1 Becton Dickinson disposable transducers
Becton Dickinson disposable transducers DX series
5 µV/V/mmHg, bridge resistor: 200 Ω to 20 kΩ, defibrillation-proof or the equivalents
Volume displacement: 0.04 mm^3/100 mmHg
Auto zero balancing range: ±200 mmHg
Auto zero balancing accuracy: ±1 mmHg
Measuring range: –50 to 300 mmHg
Measuring accuracy: ±1 mmHg ±1 digit (–50 mmHg ≤ IBP < 100 mmHg)
±1% ±1 digit (100 mmHg ≤ IBP ≤ 300 mmHg)
Total measuring accuracy*: ±4% or ±4 mmHg (whichever is greater)**
* Essential performance in EMC standard
** When used with ANSI/AAMI BP-22-1994 complied equipments
Internal noise: within ±1 mmHg
Temperature zero drift: ±0.1 mmHg/1°C
Frequency response: DC to 12 Hz or 20 Hz (selectable)
Display items: Systolic (SYS), diastolic (DIA), mean (MEAN)
Display update cycle: Every 3 s or when alarm is generated
BP sync sound: Systolic value 20 to 120 mmHg, changes in 20 steps every 5 mmHg

Alarm:

Upper limit range: 2 to 300 mmHg in 2 mmHg steps, OFF

Lower limit range: OFF, 0 to 298 mmHg steps in 2 mmHg steps

Alarm inactivation: Alarm is inactivated in certain period when zero balancing is performed.

Pulse rate

Counting range: 0, 30 to 300 beats/min

Display range: 0 to 300 beats/min

Counting accuracy (rms): ±2 beats/min (30 beats/min $\leq$ PR $\leq$ 300 beats/min)

Alarm: Upper limit range: When SYNC SOURCE is set to ECG:
16 to 300 beats/min in 1 beat/min steps, OFF
When SYNC SOURCE is set to PRESS or SpO_2:
31 to 300 beats/min in 1 beat/min steps, OFF

Lower limit range: When SYNC SOURCE is set to ECG:
OFF, 15 to 299 beats/min in 1 beat/min steps
When SYNC SOURCE is set to PRESS or SpO_2:
OFF, 30 to 299 beats/min in 1 beat/min steps

Temperature

Complies with EN 12470-4: 2000 only for clauses 6.2, 6.3 a), 6.5, 6.6, 6.7, 6.8, 6.9, 6.10 and 8.

Number of channels: Up to 4 (2 channels fixed TEMP sockets and 1 MULTI socket)

Measuring range: 0 to 45°C, 32 to 113°F

Measuring accuracy*: ±0.1°C (25°C $\leq$ TEMP $\leq$ 45°C)
±0.2°C (0°C $\leq$ TEMP < 25°C)
* Essential performance in EMC standard

Internal noise: $\leq$ 0.014°C (at 37°C)

Temperature drift: within ±0.005°C /°C

Display range: 0 to 45°C (32 to 113°F)

Display update cycle: Every 3 s or when alarm is generated

Time response delay from probe to monitor display:
$\leq$ 6 seconds (sensor time constant is not included)

Alarm

Upper limit range: 0.1 to 45.0°C (33 to 113°F) in 0.1°C (1°F) steps, OFF

Lower limit range: OFF, 0.0 to 44.9°C (32 to 112°F) in 0.1°C (1°F) steps

Carbon Dioxide, CO_2 (Mainstream method)

For the TG-900P/TG-920P/TG-950P/TG-970P* CO_2 sensor kit specifications, refer to the kit manual.

* TG-950P is not available for BSM-6000A series.

Calculation method

TG-900P/TG-920P: semi-quantitative

TG-950P/TG-970P: quantitative

CO_2 measuring range: 0 to 100 mmHg

CO_2 measuring accuracy**

TG-900P/TG-920P: ±0.4 kPa ($0 \leq CO_2 \leq 1.33$ kPa) (±3 mmHg ($0 \leq CO_2 \leq 10$ mmHg))
±0.53 kPa ($1.33 < CO_2 \leq 5.33$ kPa) (±4 mmHg ($10 < CO_2 \leq 40$ mmHg))
±10% reading ($5.33 < CO_2 \leq 13.3$ kPa ($40 < CO_2 \leq 100$ mmHg))
(At 1 atmospheric pressure, air inspiration, no condensation)

TG-950P/TG-970P: ±0.27 kPa ($0 \leq CO_2 \leq 5.33$ kPa) (±2 mmHg ($0 \leq CO_2 \leq 40$ mmHg))
±5% reading ($5.33 < CO_2 \leq 9.33$ kPa ($40 < CO_2 \leq 70$ mmHg))
±7% reading ($9.33 < CO_2 \leq 13.3$ kPa ($70 < CO_2 \leq 100$ mmHg))
(When no condensation)

	** Essential performance in EMC standard
Warm-up time:	
TG-900P/TG-920P:	5 s
TG-950P:	15 s
TG-970P:	10 s
Response time	
TG-900P:	160 ms (typical) for steps from 10 to 90%
TG-920P/TG-950P/TG-970P:	120 ms (typical) for steps from 10 to 90%
Respiration rate counting range	
TG-900P/TG-920P:	3 to 150 counts/min
TG-950P/TG-970P:	0 to 150 counts/min
Respiration rate counting accuracy	
TG-900P/TG-920P:	±5% (3 to 60 counts/min) ±10% (61 to 150 counts/min)
TG-950P/TG-970P:	±1 count/min
O_2 gas effect:	
TG-900P/TG-920P:	–10% rdg (at 100% O_2)
TG-950P/TG-970P:	–8% rdg (at 100% O_2)
N_2O anesthetic gas effect:	Accuracy in using N_2O anesthetic gas is not guaranteed
CO_2 value display update cycle:	Every 3 s or when alarm is generated
CO_2 alarm:	
Upper limit:	CO_2 (I): 1 to 5 mmHg in 1 mmHg steps, OFF 0.1 to 0.7 kPa in 0.1 kPa steps, OFF $ETCO_2$: 2 to 99 mmHg in 1 mmHg steps, OFF 1.0 to 13.5 kPa in 0.1 kPa steps, OFF
Lower limit:	$ETCO_2$: OFF, 1 to 98 mmHg in 1 mmHg steps OFF, 0.5 to 13.0 kPa in 0.1 kPa steps
Respiration rate alarm:	
Upper limit range:	2 to 150 counts/min in 2 counts/min steps, OFF
Lower limit range:	OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea time:	OFF, 5 to 40 s in 5 s steps Displayed message: APNEA
Total system response time:	≤ 1.0 second

Inspired Oxygen Fractional Concentration, O_2

Measuring parameters:	Inspired oxygen fraction concentration
Number of channels:	1
Calibration condition:	21 or 100% O_2
Measuring range:	10 to 100% O_2
Accuracy*:	±3% full scale (includes sensor, when calibrated with air) * Essential performance in EMC standard
Internal noise:	≤ 0.12% O_2RMS ±0.72% O_2
Temperature drift:	±0.12% O_2/°C
O_2 display update cycle:	Every 3 s or when alarm is generated
Alarm	
Upper limit range:	19 to 100% in 1% steps, OFF
Lower limit range:	18 to 99% in 1% steps

Cardiac Output, CO

Measuring method:	Thermodilution method

Measuring parameters:	Cardiac output (CO), injectate temperature (Ti), blood temperature (Tb), delta Tb
Number of channel:	1
Measuring range:	
Injectate temperature (Ti):	0°C to 27°C (32 to 81°F)
Blood temperature (Tb):	15°C to 45°C (59 to 113°F)
Thermodilution curve (delta Tb):	0°C to 2.5°C (32 to 37°F)
Cardiac output (CO):	0.5 to 20 L/min
Measuring accuracy:	
Ti:	±0.2°C (0°C to 27°C)
Tb:	±0.1°C (25°C ≤ TEMP ≤ 45°C) ±0.2°C (15°C ≤ TEMP < 25°C)
CO:	±5%
Internal noise:	
Ti:	≤ 0.025°C RMS
Tb:	≤ 0.016°C RMS (correspond to 37°C)
Delta Tb:	≤ 0.005°C RMS
Temperature drift:	
Ti:	±0.005°C /°C
Tb:	±0.005°C /°C
Frequency response (delta Tb):	DC to 12 Hz (–3 dB)
Injectate volume range:	3, 5, 10 mL
Display update cycle:	Updated every measurement
Tb alarm	
Upper limit range:	15.1 to 45.0°C (60 to 113°F) in 0.1°C (1°F) steps, OFF
Lower limit range:	OFF, 15.0 to 44.9°C (59 to 112°F) in 0.1°C (1°F) steps

Respiration (Thermistor method)

Complied sensor:	TR-900P respiration pickup for nose and TR-910P respiration pickup for airway
Measuring items:	Thermistor respiration curve, respiration rate
Number of channel:	1
APNEA detection:	Available
Respiration rate counting range:	0 to 150 counts/min
Respiration rate counting accuracy*:	±2 counts/min * Essential performance in EMC standard
Measurable temperature range:	10 to 40°C
Internal noise:	≤ 2.5 Ω (Referred to input)
Frequency response:	0.1 to 3 Hz (–3 dB)
Waveform display:	
Display sensitivity:	10 mm/100 Ω ±20% (at ×1 sensitivity)
Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4
Respiration rate display update cycle:	Every 3 s or when alarm is generated
Alarm:	
Upper limit range:	2 to 150 counts/min in 2 counts/min steps, OFF
Lower limit range:	OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea alarm:	OFF, 5 to 40 s in 5 s steps Displayed message: APNEA

Bispectral Index, BIS

For the BISx/BIS processor specifications, refer to the BISx/BIS processor manual.

BIS can be monitored with Aspect’s BIS monitor.

BIS alarm:	
Upper limit range:	2 to 100 in 1 steps, OFF
Lower limit range:	OFF, 0 to 99% in 1 steps

ECG/BP Output

Outputs 100 mmHg/V IBP waveform and the first trace of 1 mV/V ECG waveform. When more than one IBP waveforms are acquired, the IBP waveform of the top MULTI socket on the AY-600P series input unit is output (when “FIXED POSITION” is set for IBP Analog Output) or the IBP waveform is output following the highest priority label (when “HIGHEST PRIORITY LABEL” is set for IBP Analog Output).

Complied medical electrical equipments

Connecting medical electrical equipment must comply to the following standards:

IEC 60601-1: 1988, Amendment 1: 1991, Amendment 2: 1995
CSA C22.2 No.601.1

Medical electrical equipment must be connected by specified method in following standards:

IEC 60601-1-1: 2000
CSA C22.2 No.60601-1-1-02

Output impedance:	
ECG:	≤ 100 Ω
BP:	≤ 100 Ω
Output-waveform:	
ECG:	±5.0 V (at 1 mV/V ± 5% sensitivity)
BP:	–0.5 to +3.0 V (at 100 mmHg/V ± 1% sensitivity)
HT:	5.0 to 15.0 V (Open collector output: 0.5 to 100 mA)
Frequency response:	
ECG:	≥ 0.5 to 100 Hz (≥ –3 dB) (No reproducibility of pace maker pulse)
BP:	≥ DC to 20 Hz ±3 Hz (–3 dB)
HT pulse width:	15 ms
Gain:	
ECG:	1000
Offset:	
ECG:	≤ ±50 mV
BP:	≤ ±10 mV
Sensitivity accuracy:	
ECG:	±5%
BP:	±1%
Delay:	
ECG, HT:	20 ms max
BP:	40 ms max

RGB Socket (when QI-631P or QI-671P is connected)

Output signal:	Analog RGB signal, 0.7 Vp-p
Resolution:	
BSM-6301/BSM-6501:	800 × 600 dots
BSM-6701:	1024 × 768 dots

RS-232C Socket (when QI-631P or QI-671P is connected)

Serial communication:	RS-232C complies
Baud rate:	9600, 19200, 38400 bps

Alarm Socket (when QI-632P or QI-671P is connected)

Nurse call output: Open collector output (Low active)

When WS-671P Recorder Module is Connected

Recording method: Thermal array recording
Number of channels: 3 traces (maximum)
Recording width: ≥ 46 mm
Paper speed: 12.5, 25, 50 mm/s
Recording mode: Manual, periodic, alarm
Recording density:
  Amplitude direction: 8 dots/mm
  Feeding direction: 40 dots/mm (≤ 25 mm/s)
  20 dots/mm (50 mm/s)
Recording paper: FQW-50-2-100

When ZS-900P Transmitter is Connected

ZS-900P transmitter is not available for BSM-6000A series.

Frequency capacity deviation: ≤ ±3 ppm (15 to 35°C)
Transmission power: 1.0 mW +5%, –40% (15 to 35°C)
Spurious emission strength: ≤ 2.5 µW (5 MHz to 1.5 GHz)
Occupied bandwidth: 5.0 to 8.5 kHz
Adjacent channel leaking power: ≥ 40 dBR
Transmission frequency range: 420.0500 to 449.6625 MHz
Modulation method: Frequency shift keying

Gas

Gas can be monitored with the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit. For the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit specifications, refer to the manual.

Measurement method: Sidestream gas sampling
Measured parameters: Inspired/expired CO_2 partial pressure, inspired/expired N_2O concentration, inspired expired O_2 concentration, inspired/expired anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), respiration rate, minimum alveolar concentration
Warm-up time:
  AG-920R, GF-110PA/120PA: within 45 seconds to first measurement
  within 10 minutes to measurement with guaranteed accuracy
  GF-210R/220R: about 1 minute to CO_2 measurement
  about 6 minutes to measurement with guaranteed accuracy
Sampling rate: 70 to 100 mL/min ±10 mL/min
100 to 200 mL/min ±10%rel
Total system response time:
  AG-920R, GF-110PA/120PA: ≤ 5.0 seconds (when sampling volume is 200 mL/min, using adult sampling tube and adult water trap)
  GF-210R/220R: ≤ 5.0 seconds (when YG-610P sampling line is connected)
CO_2 measurement:
  Measurement method: Non-dispersive infrared ray absorption
  Measuring range: AG-920R, GF-110PA/120PA: 0 to 76 mmHg, 0 to 10.13 kPa
  GF-210R/220R: 0 to 10 vol%

Measuring accuracy: AG-920R, GF-110PA/120PA: ±2 mmHg ($0 \le CO_2 < 40$ mmHg), ±0.27 kPa ($0 \le CO_2 < 5.33$ kPa)
±3 mmHg ($40 \le CO_2 < 55$ mmHg), ±0.40 kPa ($5.33 \le CO_2 < 7.33$ kPa)
±4 mmHg ($55 \le CO_2 \le 76$ mmHg), ±0.53 kPa ($7.33 \le CO_2 \le 10.13$ kPa)

NOTE for AG-920R and GF-110PA/120PA

CO_2 measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:3, 1:2, 1:1 and 2:1.

GF-210R/220R: ± (0.43 vol% + 8%rel)

NOTE for GF-210R and GF-220R

CO2 measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%): AG-920R, GF-110PA/120PA: ≤ 250 ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)

Alarm: Upper limit: CO_2(I): 1 to 5 mmHg in 1 mmHg steps, OFF
0.1 to 0.7 kPa in 0.1 kPa steps, OFF
$ETCO_2$: 2 to 99 mmHg in 1 mmHg steps, OFF
1.0 to 13.5 kPa in 0.5 kPa steps, Off
Lower limit: $ETCO_2$: OFF, 1 to 98 mmHg in 1 mmHg steps
OFF, 0.5 to 13.0 kPa in 0.5 kPa steps

N_2O measurement:

Measurement method: Non-dispersive infrared ray absorption
Measuring range: AG-920R, GF-110PA/120PA: 0 to 100%
GF-210R/220R: 0 to 100 vol%
Measuring accuracy: AG-920R, GF-110PA/120PA: ±3%

NOTE for AG-920R and GF-110PA/120PA

N_2O measurement accuracy is maintained up to a respiratory rate of 30 bpm with I:E ratio of 1:3, up to a respiratory rate of 40 bpm with I:E ratio of 1:2 and up to a respiratory rate of 60 bpm with I:E ratio of 1:1 and 2:1.

GF-210R/220R: ±(2vol% + 8%rel)

NOTE

N_2O measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%): AG-920R, GF-110PA/120PA: ≤ 250 ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)

Alarm (N_2O(I), N_2O(E)): Upper limit: 1 to 100% in 1% steps, OFF
Lower limit: OFF, 0 to 99% in 1% steps

O_2 measurement:

Measurement method:	Paramagnetic	
Measuring range:	0 to 100%	
Measuring accuracy:	AG-920R, GF-110PA/120PA:	±2% ($0 \le O_2 < 55\%$) ±3% ($55 \le O_2 \le 100\%$)
	GF-210R/220R:	±(2.5 vol% + 2.5%rel)

NOTE for GF-210R/220R

O_2 measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%):	AG-920R, GF-110PA/120PA:	≤ 500 ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)
Alarm:	Upper limit:	O_2(I): 19 to 100% in 1% steps, OFF O_2(E): 11 to 100% in 1% steps, OFF
	Lower limit:	O_2(I): 18 to 99% in 1% steps O_2(E): OFF, 10 to 99% in 1% steps

Anesthetic agent measurement:

Measurement method:	Non-dispersive infrared ray absorption	
Measured items:	HAL (Halothane), ISO (Isoflurane), ENF (Enflurane), SEV (Sevoflurane), DES (Desflurane)	
Measuring range:	AG-920R, GF-110PA/120PA:	HAL, ISO, ENF 0 to 5% SEV 0 to 8% DES 0 to 18%
	GF-210R/220R:	HAL, ISO 0 to 8.5 vol% ENF, SEV 0 to 10 vol% DES 0 to 20% vol%
Measuring accuracy:	AG-920R, GF-110PA/120PA:	±0.2% ($0 \le GAS \le 5\%$) ±0.4% ($5 < GAS \le 10\%$) ±0.6% ($10 < GAS \le 15\%$) ±1.0% ($15 < GAS \le 18\%$)

NOTE for AG-920R, GF-110PA and GF-120PA

Anesthetic agent accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:3, 1:2, 1:1 and 2:1.

GF-210R/220R:	± (0.2 vol% +15%rel)

NOTE for GF-210R/220R

Anesthetic agent accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%) :	AG-920R, GF-110PA/120PA:	≤ 300 ms (HAL, ISO, SEV, DES) ≤ 500 ms (ENF) (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)
Alarm:	Upper limit:	Agent(I), Agent(E) (HAL, ISO, SEV, ENF): 0.1 to 7.0% in 0.1% steps, OFF

DES(I), DES(E): 0.1 to 20.0% in 0.1% steps, OFF
Lower limit: Agent(I), Agent(E) (HAL, ISO, SEV, ENF):
OFF, 0.0 to 6.9% in 0.1% steps, OFF
DES(I), DES(E): OFF, 0.0 to 19.9% in 0.1% steps

MAC:

Uncorrected MAC: When AG-920R multigas unit is connected
Uncorrected MAC = %Et(AA1)/x(AA) + %Et(AA2)/x(AA) + %Et(N_2O)/x(N_2O)
%Et(AA1): End tidal concentration of the first anesthetic agent
%Et(AA2): End tidal concentration of the second anesthetic agent
%Et(N_2O): End tidal concentration of N2O
x(AA): Uses the following values with the MAC of the first anesthetic agent
HAL = 0.77%, ENF = 1.7%, ISO = 1.15%, SEV = 2.1%, DES = 7.3%
x(N_2O):Uses 105% with the MAC of N_2O
For the GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.

Ambient pressure corrected MAC: For GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.

Enhanced MAC correction: For GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.

Respiration rate:
Measuring range: 0, 4 to 60 counts/min
Measuring accuracy: ±1 count/min
Alarm: Upper limit: 2 to 150 counts/min in 2 counts/min steps, OFF
Lower limit: OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea alarm: OFF, 5 to 40 s in 5 s steps
Displayed message: APNEA

Carbon Dioxide, CO_2 (Sidestream method)

CO_2 in sidestream method can be monitored with the AG-400R CO_2 unit.
For the AG-400R CO_2 unit specifications, refer to the AG-400R CO_2 unit manual.

Sampling flow: 50 mL/min +15/−7.5 mL/min
Warm up time: 30 s average (from power on to the measurable state)
Measuring range: 0 to 99 mmHg
Total measuring accuracy: Whichever greater in following measuring accuracy
Measuring accuracy: 0 to 38 mmHg ±2 mmHg
39 to 99 mmHg ± [5 + 0.08 × ($\chi - 39$)] % of reading
χ: CO_2 partial pressure of a standard gas with a known CO_2 partial pressure (mmHg)

$ETCO_2$ and CO_2(I) alarm:
Upper limit: CO_2(I) : 1 to 5 mmHg in 1 mmHg steps, OFF
0.1 to 0.7 kPa in 0.1 kPs steps, OFF
$ETCO_2$: 2 to 99 mmHg in 1 mmHg steps, OFF
1.0 to 13.5 kPa in 0.5 kPa steps, OFF
Lower limit: $ETCO_2$: OFF, 1 to 98 mmHg in 1 mmHg steps
OFF, 0.5 to 13.0 kPa in 0.5 kPa steps

Respiration rate measuring range: 0 to 150 counts/min
Respiration rate measuring accuracy: 101 to 150 counts/min: ±5%
71 to 100 counts/min: ±3%
41 to 70 counts/min: ±2 counts/min

0 to 40 counts/min: ±1 count/min
Respiration rate alarm:
    Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF
    Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps
    Apnea alarm: OFF, 5 to 40 s in 5 s steps
        Displayed message: APNEA
Total system response time: ≤ 3.5 seconds

FLOW/Paw

Flow/Paw can be monitored with the GF-120PA or GF-220R multigas/flow unit. For the GF-120PA or GF-220R multigas/flow unit specifications, refer to the GF-120PA or GF-220R multigas/flow unit manual.

FLOW measurement:
Measurement method: Differential pressure method (fixed orifice)
    Measuring range: –3 to +3 L/s
    Measuring accuracy: ±3% rel or ±0.005 L/s whichever is greater
        Applicable when 10 minutes or more has elapsed
Paw measurement:
    Ppeak, Pmean, PEEP: Measuring range: –20 to +100 cmH$_2$O, hPa
        Measuring accuracy: ±1 cmH$_2$O, hPa
        Applicable when 10 minutes or more has elapsed
    Ppeak alarm: Upper limit range: 1 to 100 cmH$_2$O, hPa in 1 cmH$_2$O, hPa steps, OFF
        Lower limit range: OFF, 0 to 99 cmH$_2$O, hPa in 1 cmH$_2$O, hPa steps
    PEEP alarm: Upper limit range: 1 to 50 cmH$_2$O, hPa in 1 cmH$_2$O, hPa steps, OFF
        Lower limit range: OFF, 0 to 49 cmH$_2$O, hPa in 1 cmH$_2$O, hPa steps
Volume measurement:
    Measuring range: 0 to 3000 mL
    Measuring accuracy: ±5% rel or ±10 mL whichever is greater
        Applicable when 10 minutes or more has elapsed
TVe, TVi measurement:
    Measuring range: 0 to 3000 mL
    Display range: 0 to 9999 mL
    Measuring accuracy: ±5% rel or ±10 mL whichever is greater
        Applicable when 10 minutes or more has elapsed
        Not applicable when TVi and TVe is less than 100 mL
MV measurement:
    Display range: 0 to 99.9 L/min
    Alarm: Upper limit range: 0.1 to 30.0 L/min in 0.1 L/min steps, OFF
        Lower limit range: OFF, 0.0 to 29.9 L/min in 0.1 L/min steps
C measurement:
    Display range: 0.0 to 999.9 mL/cmH$_2$O
R, Ri, Re measurement:
    Display range: 0.0 to 999.9 cmH$_2$O/L/s
Respiration rate measurement:
    Counting range: 0, 4 to 60 counts/min
    Counting accuracy: ±1 counts/min
    Alarm: Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF
        Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps
        Apnea time: OFF, 5 to 40 s in 5 s steps
            Displayed message: APNEA

EEG

EEG can be monitored with the AE-918P neuro unit. For the AE-918P neuro unit specifications, refer to the AE-918P neuro unit manual.

Number of channels:	8
Measuring range:	
SEF, MDF, PPF:	0.0 to 62.5 Hz
TP:	0.01 to 9.99 nW
ABS δ, ABS θ, ABS α, ABS β, ABS γ:	1 to 9999 pW
% δ, % θ, % α, % β, % γ:	0 to 100%
Data display update cycle:	Every 3 s or when alarm is generated
Electrode impedance check:	> 10 kΩ within ±20%
Sensitivity:	10 µV/1 mm within ±5%
Non distorted maximum input:	> ±2 mV
Polarization voltage:	> ±700 mV
Input impedance:	> 15 MΩ at 10 Hz
CMRR:	> 110 dB (in isolation mode)
Frequency characteristics:	
High range:	70 Hz at 70% amplitude (−3 dB) within ±20%
Low range:	2 s ±20% or 0.08 Hz at 70% amplitude (−3 dB) within ±20%
AC filter:	attenuation ratio > 26 dB
Noise:	within 3 µVp-p
SEF alarm:	
Upper limit range:	1.0 to 60.0 Hz in 0.5 Hz steps, OFF
Lower limit range:	OFF, 0.5 to 59.5 Hz in 0.5 Hz steps
TP alarm:	
Upper limit range:	0.02 to 9.99 nW in 0.01 nW steps, OFF
Lower limit range:	OFF, 0.01 to 9.98 nW in 0.01 nW steps

Battery (SB-671P Battery Pack)

Type of battery:	Nickel-metal hydride
Number of batteries:	2
Battery lifetime:	1 year or 200 cycles of full discharging/charging
Battery operation time:	
BSM-6301/6501:	90 minutes
BSM-6701:	60 minutes (new battery, fully charged and no options are used in normal temperature)
DC voltage:	9.6 V
Charging current:	360 mA ±50 mA (normal use)
Charging time:	
During monitoring:	10 hours
During non-monitoring:	6 hours (two battery at the same time)
Battery status indication:	Battery lamps on the front panel, screen message and alarm sound, alarm indicator
Operating environment:	
Charging temperature:	10 to 55°C (50 to 131°F)
Discharging temperature:	5 to 50°C (41 to 122°F)
Humidity:	30 to 85% RH (noncondensing)
Atmospheric pressure:	700 to 1060 hPa

Transport and storage environment: When the battery pack is stored more than 6 months, charge and discharge or charge the battery once every 6 months.
- Temperature: –20 to +60°C (–4 to +140°F) (within 30 days)
  –20 to +45°C (–4 to +113°F) (within 90 days)
  –20 to +35°C (–4 to +95°F) (more than 90 days)
- Humidity: 20 to 85% RH (noncondensing)
- Atmospheric pressure: 700 to 1060 hPa

Power Requirement

Line voltage:
- AC: AC 100 to 240 V ±10%
- DC (SB-671P): 8.5 to 12.6 V

Line frequency: 50 or 60 Hz

Power consumption:
- BSM-6301: AC 140 VA
- BSM-6501: AC 90 VA
- BSM-6701: AC 100 VA

Clock Accuracy

At operating temperature 25°C: approx. ±2 min 40 s/month maximum

At storage temperature –20 to +60°C: approx. ±6 min/month maximum

Environment

Operating environment:
- Temperature: 10 to 40°C (50 to 104°F)
- Humidity: 30 to 85% RH (10 to 40°C, noncondensing)
- Atmospheric pressure: 700 to 1060 hPa

Transport and storage environment:
- Temperature: –20 to +65°C (–4 to +149°F)
  –15 to +55°C (Recording paper)
- Humidity: 10 to 95% RH
- Atmospheric pressure: 700 to 1060 hPa

Mechanical Strength

Mechanical strength: Indoor mobile type

Electromagnetic Compatibility

IEC 60601-1-2: 2001
IEC 60601-1-2 Amendment 1: 2004

Safety Standard

Safety standard:
CAN/CSA C22.2 No. 601-1 M90 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 601-1S1-94 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 601-1B-98 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 60601-1-1-02 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 601.2.27-98 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 60601-2-30-02 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 60601-2-34-02 (BSM-6501A, BSM-6701A)
CAN/CSA C22.2 No. 60601-2-49-04 (BSM-6501A, BSM-6701A)

EN 12470-4: 2000*[1]
IEC 60601-1: 1988
IEC 60601-1 Amendment 1: 1991
IEC 60601-1 Amendment 2: 1995
IEC 60601-1-1: 2000
IEC 60601-1-2: 2001
IEC 60601-1-2 Amendment 1: 2004
IEC 60601-1-6: 2006
IEC 60601-1-8: 2006*[2]*[3]
IEC 60601-2-27: 1994 - Particular requirements for the safety of electrocardiographic monitoring equipment
IEC 60601-2-27: 2005 - Particular requirements for the safety, including essential performance, of electrocardiographic monitoring equipment
IEC 60601-2-30: 1999 - Particular requirements for the safety of automatic cycling in in-direct blood pressure monitoring equipment
IEC 60601-2-34: 2000 - Particular requirements for the safety of direct blood pressure monitoring equipment*[4]
IEC 60601-2-49: 2001 - Particular requirements for the safety of multifunction patient monitoring equipment
ISO 21647: 2004
ISO 9919: 2005

*[1] This monitor complies with EN 12470-4: 2000 only for clauses 6.2, 6.3 a), 6.5, 6.6, 6.7, 6.8, 6.9, 6.10 and 8.

*[2] Only the “IEC standard” alarm sound complies with clause 6.3.3.2.

*[3] This monitor complies with IEC 60601-1-8: 2006 except for interbed alarm.

*[4] This monitor complies with IEC 60601-2-34: 2000 except for clauses 44.6, 45.101 a) and 45.101 b).

Type of protection against electrical shock:
CLASS I EQUIPMENT (AC Powered)
Internally Powered EQUIPMENT (BATTERY Powered)

Degree of protection against electrical shock:

Defibrillator-proof type CF applied part:

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P and AY-673P:
ECG, respiration (impedance and thermistor method), IBP, temperature, SpO$_2$, SpO$_2$-2, CO$_2$, O$_2$, NIBP, BIS

AY-660P: ECG, respiration (impedance method), IBP, temperature, SpO$_2$, CO$_2$, NIBP

AA-672P, AA-674P, JA-694P: Respiration (thermistor method), IBP, temperature, SpO$_2$-2, CO$_2$, O$_2$, BIS

CF applied part:

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P, AY-673P, AA-672P, AA-674P and JA-694P:
CO

Degree of protection against harmful ingress of water:
IPX0 (non-protected)

Degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE:
Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE

Mode of operation: CONTINUOUS OPERATION

Dimensions and Weight (approximate)

MU-631R main unit	Dimensions: 316 W × 325 H × 188 D mm (excluding protruding parts) Weight: 5.3 kg
MU-651R main unit	Dimensions: 342 W × 353 H × 183 D mm (excluding protruding parts) Weight: 7.0 kg
MU-671R main unit	Dimensions: 415 W × 392 H × 191 D mm (excluding protruding parts) Weight: 9.0 kg
AY-631P/AY-633P/AY-651P/AY-653P/AY-660P/AY-661P/AY-663P/AY-671P/AY-673P input unit	Dimensions: 83 W × 176 H × 145 D mm (excluding protruding parts) Weight: 1.3 kg
AA-672P/AA-674P smart expansion unit	Dimensions: 38 W × 165 H × 145 D mm (excluding protruding parts) Weight: 0.5 kg
WS-671P recorder module	Dimensions: 77 W × 73 H × 120 D mm (excluding protruding parts) Weight: 0.35 kg
QI-631P interface	Dimensions: 28.5 W × 94 H × 106 D mm (excluding protruding parts) Weight: 0.1 kg
QI-632P/QI-634P interface	Dimensions: 27 W × 94 H × 106 D mm (excluding protruding parts) Weight: 0.1 kg
QI-671P interface	Dimensions: 29 W × 173 H × 112 D mm (excluding protruding parts) Weight: 0.16 kg
QI-672P interface	Dimensions: 26 W × 173 H × 107 D mm (excluding protruding parts) Weight: 0.15 kg
RY-910PA remote controller	Dimensions: 45 W × 35 H × 135 D mm Weight: 0.08 kg
Interface QF series:	Dimensions: 65 W × 23 H × 44 D mm (excluding cables) Weight: 0.13 kg
Communication cable IF series:	Dimensions: 65 W × 23 H × 44 D mm (excluding cables) Weight: 0.13 kg
JA-690PA/JA-694PA data acquisition unit:	Dimensions: 145 mm W × 205 mm H × 190 mm D Weight: 1.8 kg (JA-690PA), 2.0 kg (JA-694PA)

Electromagnetic Emissions

The BSM-6000’s essential performances in EMC standard satisfy the following criteria.

This Model BSM-6000 is intended for use in the electromagnetic environment specified below.
The customer or the user of the BSM-6000 should assure that it is used in such an environment.

BSM-6301 and BSM-6501 (JA-690PA/JA-694PA data acquisition unit, QE-910P BIS processor and QI-320PA wireless LAN station are not connected)

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The BSM-6301 and BSM-6501 (JA-690PA/JA-694PA, QE-910P and QI-320PA are not connected) use RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B*[1]	The BSM-6301 and BSM-6501 (JA-690PA/JA-694PA, QE-910P and QI-320PA are not connected) are suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A*[2]	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

*[1] BSM-6301 and BSM-6501 (when ZS-900P is connected) are CLASS A equipment if the equipments comply with IEC 60601-1-2: 2001 36.201.1 5 in the countries which do not have national wireless rule.

*[2] BSM-6301 is not applicable.

BSM-6301, BSM-6501 (JA-690PA/JA-694PA data acquisition unit, QE-910P BIS processor and QI-320PA wireless LAN station are connected) and BSM-6701

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The BSM-6301, BSM-6501 (JA-690PA/JA-694PA, QE-910P or QI-320PA is connected) and BSM-6701 use RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The BSM-6301, BSM-6501 (JA-690PA/JA-694PA, QE-910P or QI-320PA is connected) and BSM-6701 are suitable for use in all establishments, excluding domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A*	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

* BSM-6301 is not applicable.

Electromagnetic Immunity

The BSM-6000’s essential performances in EMC standard satisfy the following criteria.

This Model BSM-6000 is intended for use in the electromagnetic environment specified below.
The customer or the user of the BSM-6000 should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tiles. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 s	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the BSM-6000 requires continued operation during power mains interruptions, it is recommended that the BSM-6000 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the AC mains voltage prior to application of the test level			

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the BSM-6000 including cables than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m 80 MHz to 2.5 GHz	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*[1], should be less than the compliance level in each frequency range*[2]. Interference may occur in the vicinity of equipment marked with the following symbol: ((•))

NOTE 1: At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

*[1] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the BSM-6000 is used exceeds the applicable RF compliance level above, the BSM-6000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the BSM-6000.

*[2] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances between Portable and Mobile RF Communications Equipment

The BSM-6000 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the BSM-6000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the BSM-6000 as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (W)	Separation distance according to frequency of transmitter (m)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

System Composition for EMC Test

The BSM-6000 bedside monitor is tested to comply with IEC 60601-1-2: 2001 and Amendment 1: 2004 with the following composition. If any part which is not specified by Nihon Kohden is used, the EMC specifications might not comply.

Units	Cable length
MU-631R/MU-651R/MU-671R main unit	—
AY-633P/AY-660P/AY-673P input unit	—
QM-600P memory unit	—
AA-674P smart expansion unit	—
QI-631P/QI-632P/QI-634P/QI-671P/QI-672P interface	—
BJ-900P ECG patient cable	3.8 m
JL-900P SpO_2 connection cord	2.5 m
TL-201T finger probe	1.6 m
JL-650P SpO_2 connection cord	3.0 m
JL-630P SpO_2 connection cord	3.0 m
LNOP-DCI Masimo adult reusable sensor	—
YN-921P air hose for neonate	3.5 m
YP-821P disposable cuff for neonate	0.2 m
YN-901P air hose for adult/child	3.5 m
YP-963T cuff for adult	0.15 m
JP-900P IBP connection cord	3.5 m
DX-300 monitoring kit	—
JT-950P CO connection cord	2.0 m
TC-704MU Becton Dickinson catheter soft type	1.1 m
SP-5030 bath probe	1.5 m
JT-900P temperature connection cord	0.3 m
401J thermistor probe for adult	3.5 m
402J thermistor probe for child	3.5 m
TG-900P CO_2 sensor kit	3.0 m
TG-920P CO_2 sensor kit	3.5 m
TG-950P CO_2 sensor kit	4.0 m
JO-900P FiO_2 connection cord	3.0 m
074705 oxygen sensor	0.6 m
TR-900P respiration pickup for nose	3.0 m
YJ-671P BISx connection cord	0.3 m
QE-910P BIS processor	—
YJ-910P ECG/BP output cable	5.0 m
QF-901P interface (including a cable for Drager ventilator)	—
QF-902P interface (including a cable for A-2000 BIS monitor)	—
QF-903P interface (including a cable for Vigilance CCO monitor)	—
QF-904P interface (including a cable for AG-920R multigas unit)	—
QF-905P interface (including a cable for AG-400R CO_2 unit)	—
YS-080P3 RGB cable	10 m
YS-089P2 serial connection cable	10 m
Basic optical mouse	—
SB-671P battery pack	—
ZS-900P transmitter	—
YS-089P7 network connection cable	0.7 m
QW-100Y (HIT-100) hyper isolation transformer	—
RY-910PA remote controller	—
Power cord W	2.5 m
Power cord H	2.5 m
Power cord N	2.4 m
Power cord UL	2.5 m
Power cord GB	2.5 m
Grounding lead	—
QI-320PA wireless LAN station	—
QI-600P interface unit	—
JA-690PA/JA-694PA data acquisition unit	—
YS-096P2/YS-096P3 unit connection cable	2.5 m/5.0 m
YS-096P5 multi-link cable	0.27 m

NOTE

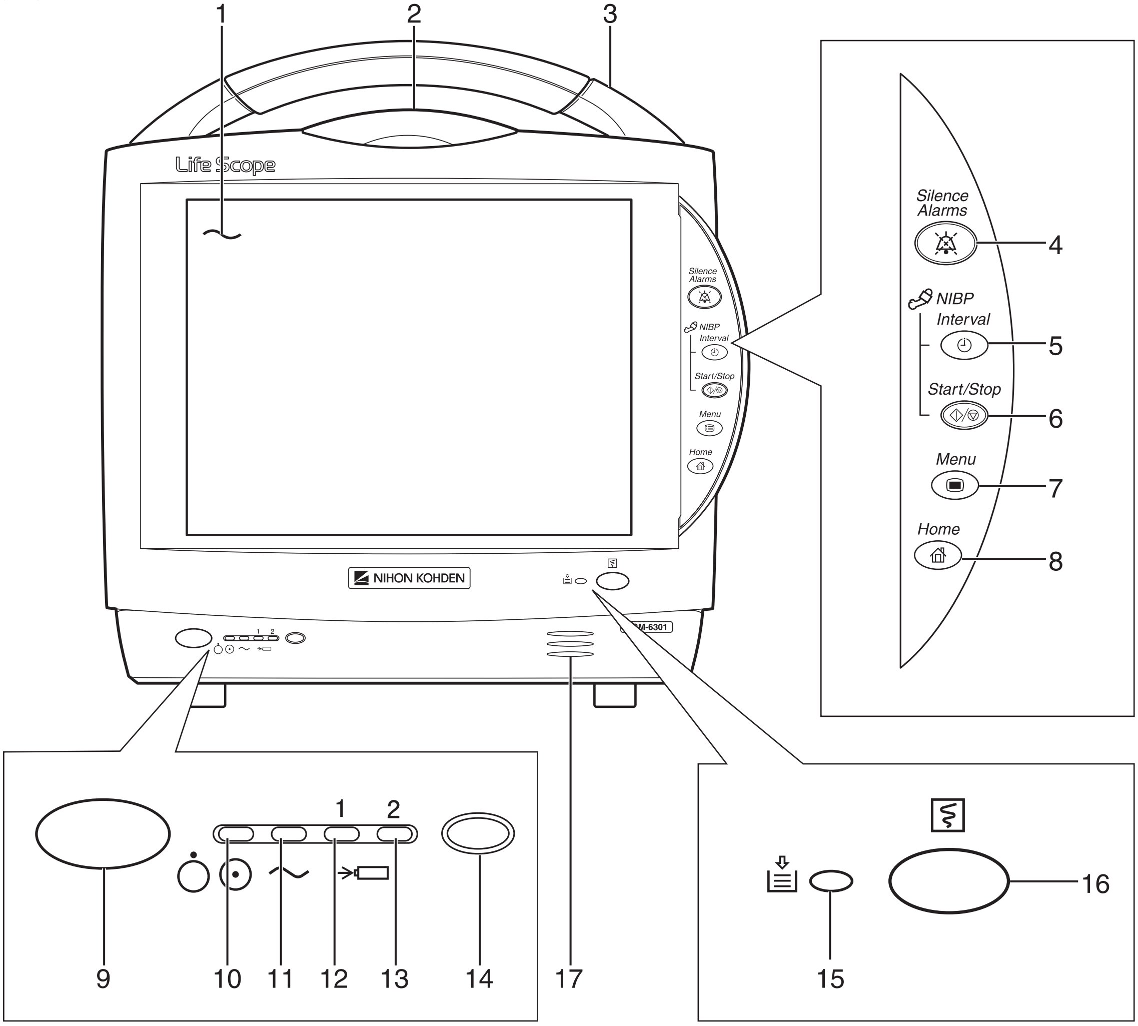
When the following units are used, IEC 60601-1-2: 1993 complies.

- Multigas unit AG-920R
- CO_2 unit AG-400R

Panel Description

MU-631R Main Unit

Front Panel



1 Touch screen
Displays monitoring data. Touching a key or data on the screen changes the displayed screen and settings.

2 Alarm indicator
Red or yellow lamp blinks, or yellow or cyan lamps lights according to the alarm settings. Green lamp blinks in synchronization with the patient's QRS or pulse.

3 Handle
For carrying the monitor.

4 Silence Alarms key
Silences the alarm sound.

5 NIBP Interval key
Selects NIBP measurement mode. Pressing this key changes the mode.

6 NIBP Start/Stop key
Starts NIBP measurement in selected mode. Pressing the key during measurement stops measurement.

7 Menu key
Displays the MENU window.

8 Home key
Closes all opened windows and displays the home screen.

9 Power switch
Press to turn the monitor power on. When turning the monitor power off, press and hold for more than three seconds.

10 Power lamp
Lights when the monitor power is turned on.

11 AC power lamp
Lights when the power cord is connected between the AC SOURCE socket and AC outlet.

12 Battery lamp 1
Indicates a battery status of the battery in the battery slot 1.

13 Battery lamp 2
Indicates a battery status of the battery in the battery slot 2.

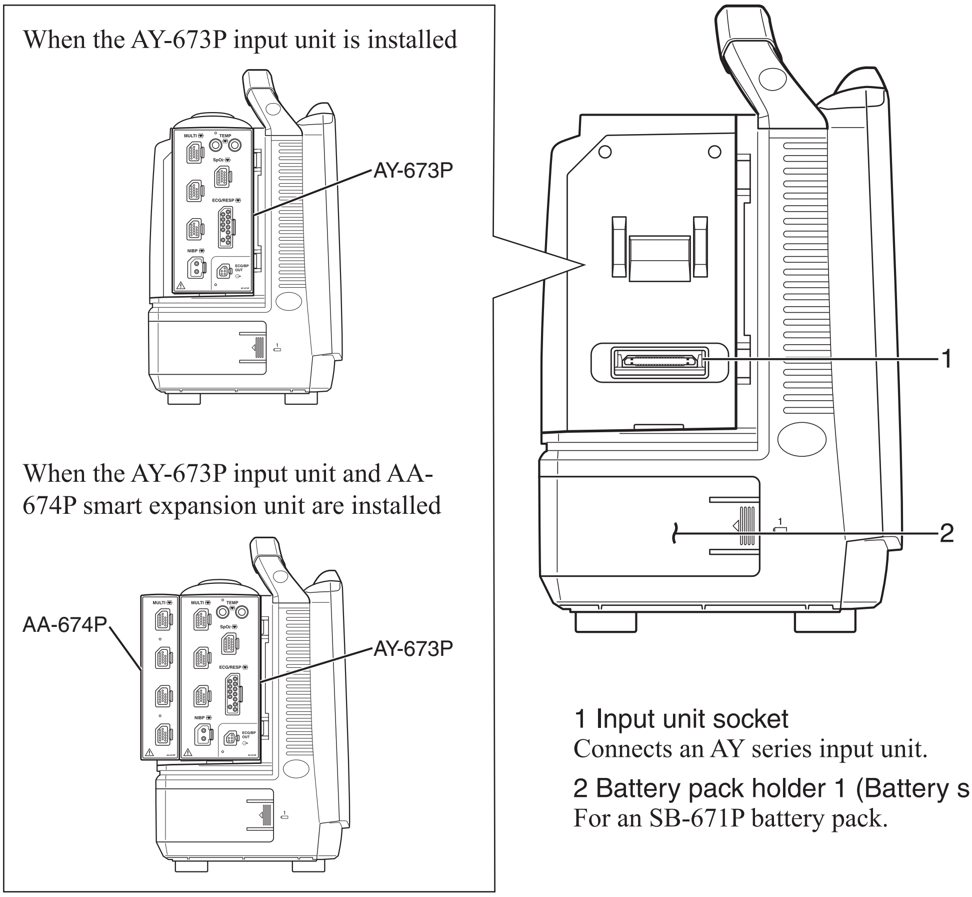
14 Remote control sensor
Receives an infrared signal from the remote control.

15 ERROR lamp (option)
Blinks when out of paper. Lights when the recorder door is open.

16 RECORD/STOP key (option)
Press to start or stop recording.

17 Speaker
For alarms and sync sound.

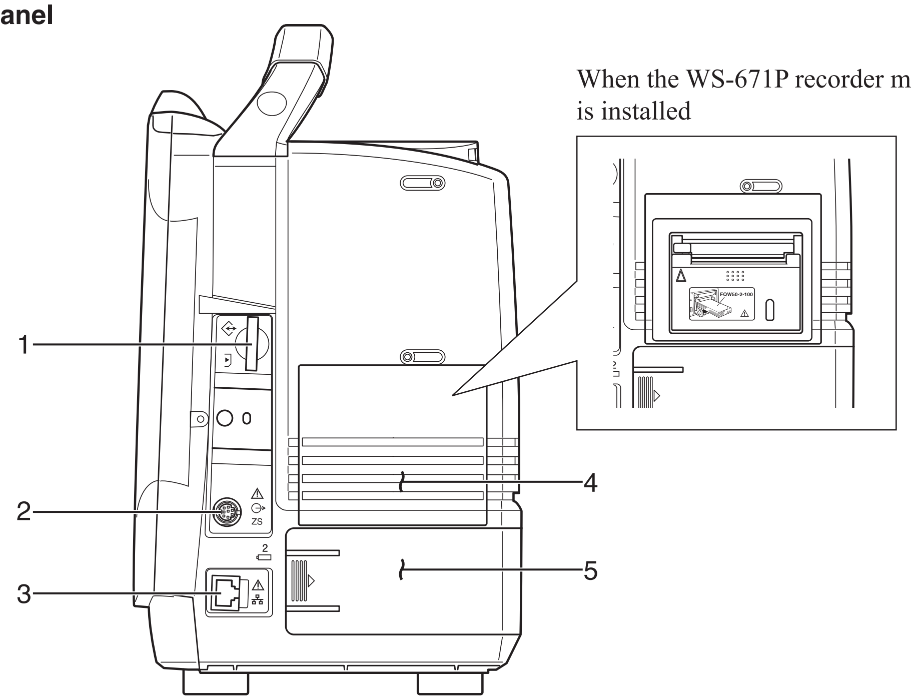
Left Side Panel


When the AY-673P input unit is installed
AY-673P
When the AY-673P input unit and AA-674P smart expansion unit are installed
AA-674P
AY-673P
1
2

1 Input unit socket
Connects an AY series input unit.

2 Battery pack holder 1 (Battery slot 1)
For an SB-671P battery pack.

Right Side Panel


When the WS-671P recorder module is installed
1
2
3
4
5
ZS

1 SD card slot
For an SD card or program card.

2 ZS socket
For the ZS-900P* transmitter.
*ZS-900P transmitter is not available for BSM-6000A series.

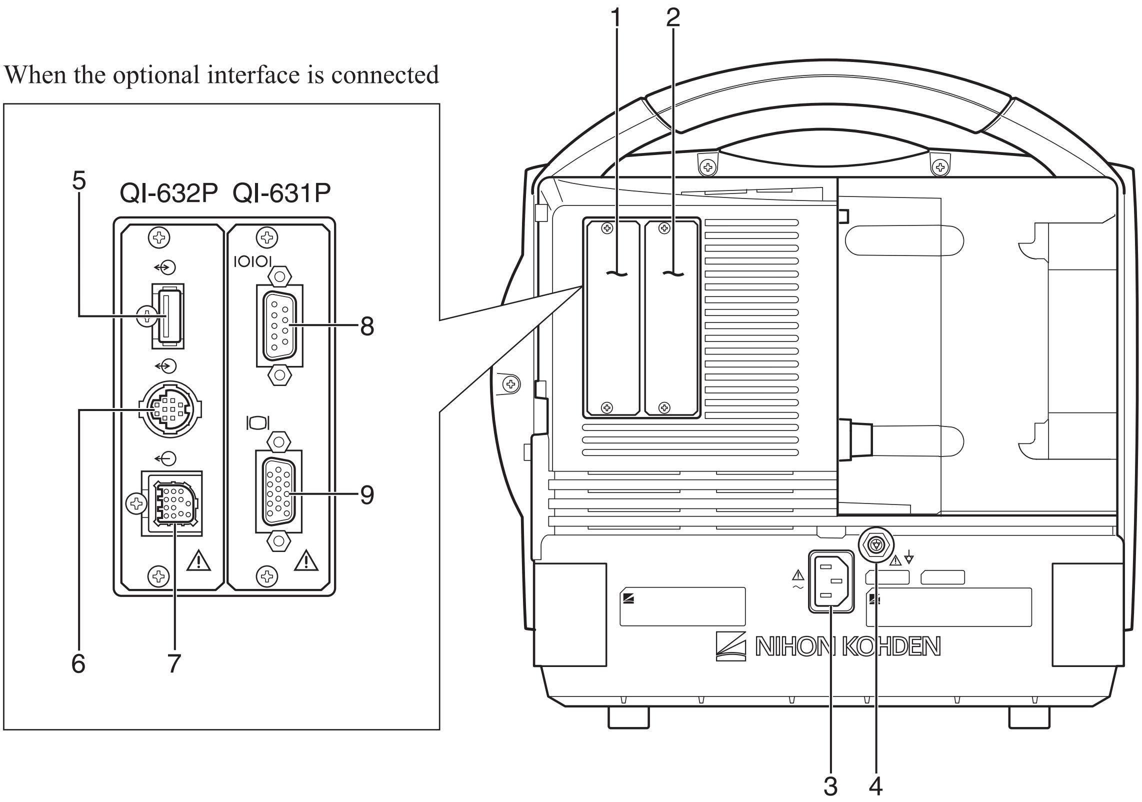
3 Network socket
Connects to monitor network system via the network separation unit.

4 Recorder module holder
For the WS-671P recorder module.

5 Battery pack holder 2 (Battery slot 2)
For an SB-671P battery pack.

Rear Panel

Example shows the QI-631P and QI-632P interfaces installed.



1 QI-632P/QI-634P interface socket
Connects the QI-632P or QI-634P interface.

2 QI-631P interface socket
Connects the QI-631P interface.

3 AC SOURCE power cord socket
For the AC power cord.

4 Equipotential grounding terminal
For an equipotential grounding lead.

5 USB socket (QI-632P/QI-634P)
Connects a mouse or bar code reader.

6 Multi-link socket (QI-632P/QI-634P)
Connects a QF series interface, IF series communication cable or multi-link cable of an external unit.

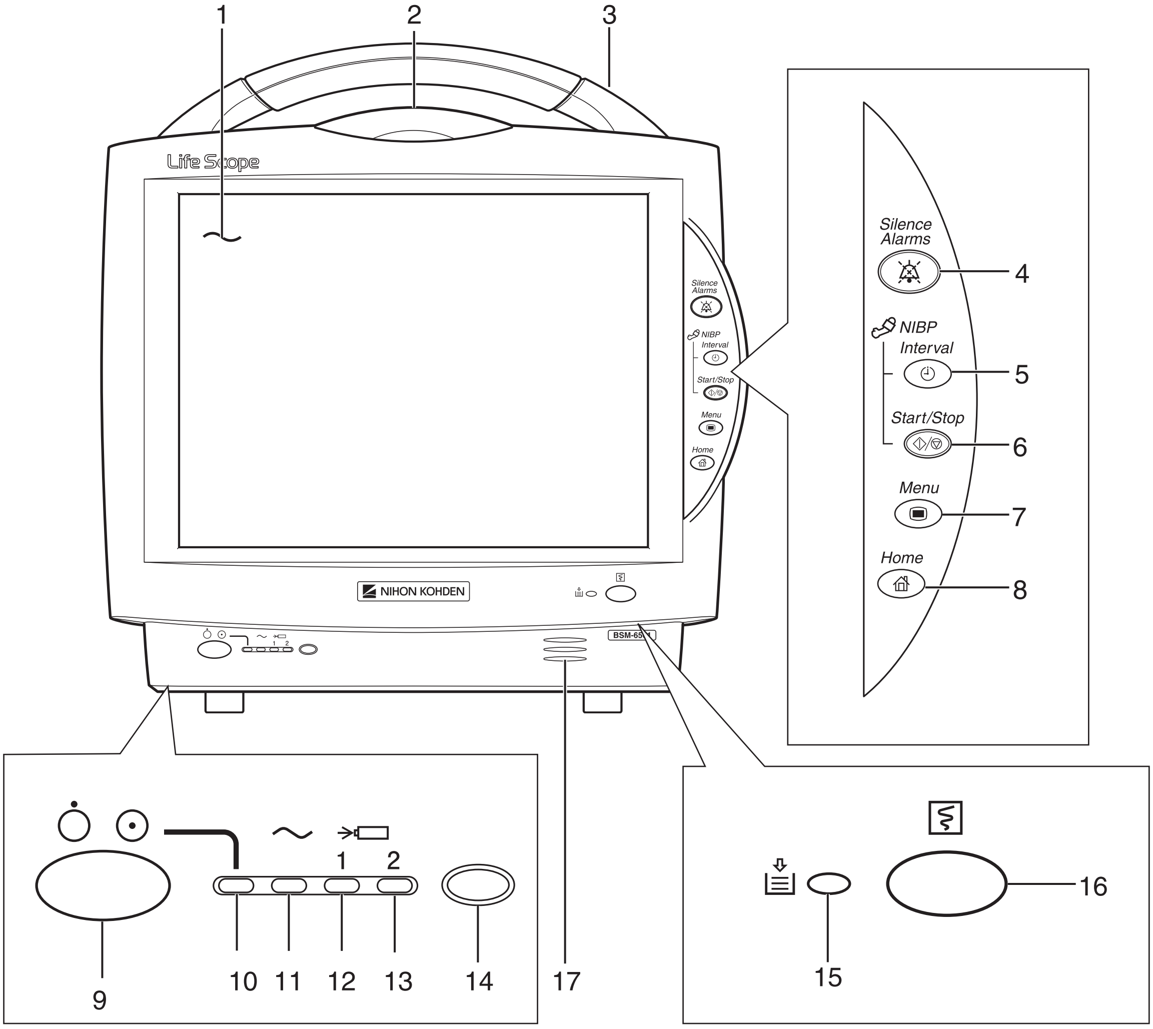
7 Alarm socket (QI-632P)
Connects a YJ-672P nurse call cable.

8 RS-232C socket (QI-631P)
Connects a YJ-672P nurse call cable.

9 RGB socket (QI-631P)
Outputs the RGB video signal. Connects to the slave display.

MU-651R/MU-671R Main Unit

Front Panel



1 Touch screen
Displays monitoring data. Touching a key or data on the screen changes the displayed screen and settings.

2 Alarm indicator
Red or yellow lamp blinks, or yellow or cyan lamps lights according to the alarm settings. Green lamp blinks in synchronization with the patient's QRS or pulse.

3 Handle
For carrying the monitor.

4 Silence Alarms key
Silences the alarm sound.

5 NIBP Interval key
Selects NIBP measurement mode. Pressing this key changes the mode.

6 NIBP Start/Stop key
Starts NIBP measurement in selected mode. Pressing the key during measurement stops measurement.

7 Menu key
Displays the MENU window.

8 Home key
Closes all opened windows and displays the home screen.

9 Power switch
Press to turn the monitor power on. When turning the monitor power off, press and hold for more than three seconds.

10 Power lamp
Lights when the monitor power is turned on.

11 AC power lamp
Lights when the power cord is connected between the AC SOURCE socket and AC outlet.

12 Battery lamp 1
Indicates a battery status of the battery in the battery slot 1.

13 Battery lamp 2
Indicates a battery status of the battery in the battery slot 2.

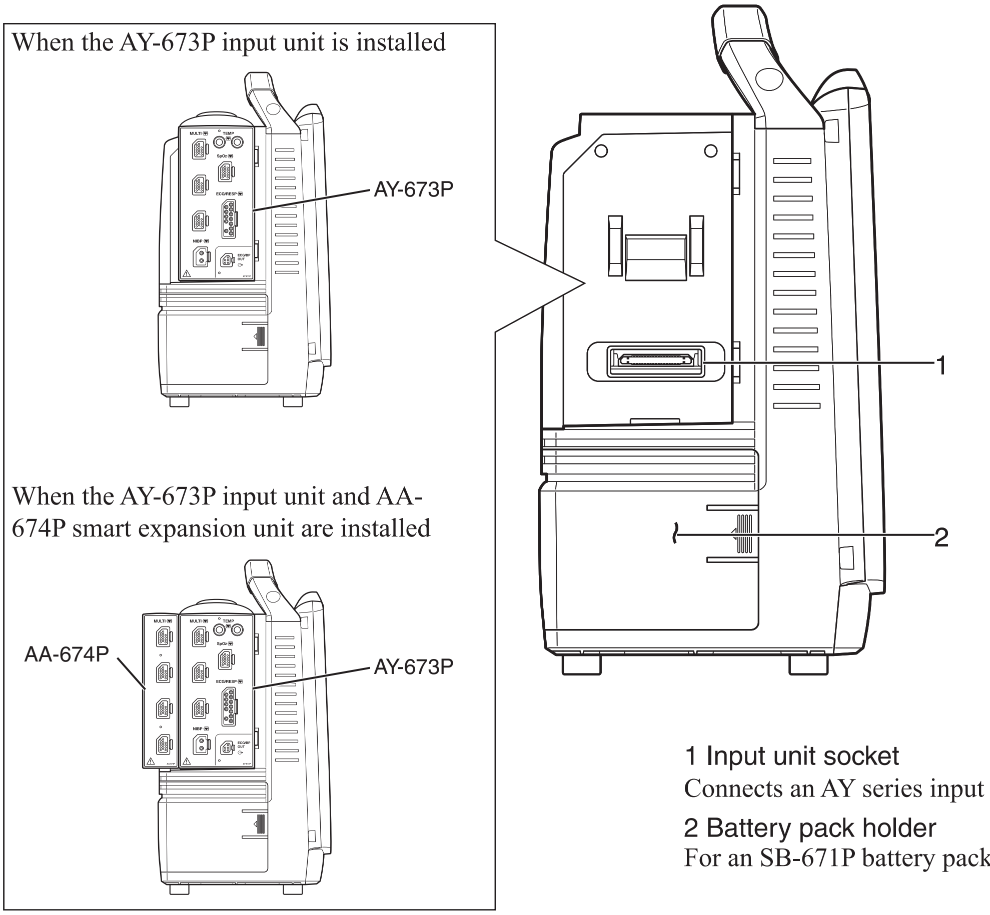
14 Remote control sensor
Receives an infrared signal from the remote control.

15 ERROR lamp (option)
Blinks when out of paper. Lights when the recorder door is open.

16 RECORD/STOP key (option)
Press to start or stop recording.

17 Speaker
For alarms and sync sound.

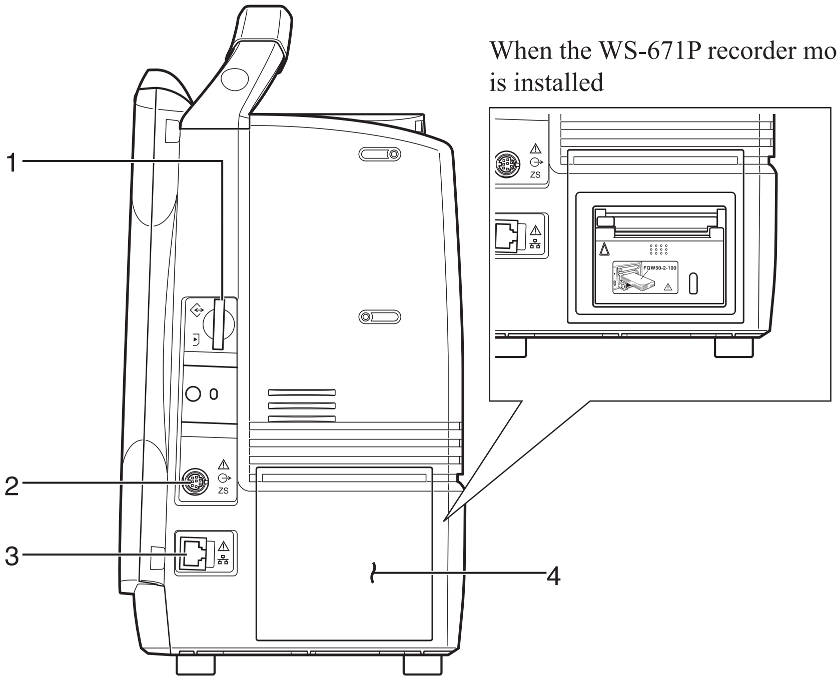
Left Side Panel


When the AY-673P input unit is installed
AY-673P
When the AY-673P input unit and AA-674P smart expansion unit are installed
AA-674P
AY-673P
1
2

1 Input unit socket
Connects an AY series input unit.

2 Battery pack holder
For an SB-671P battery pack.

Right Side Panel


When the WS-671P recorder module is installed
ZS
FQW50-2-100
1
2
ZS
3
4

1 SD card slot
For an SD card or program card.

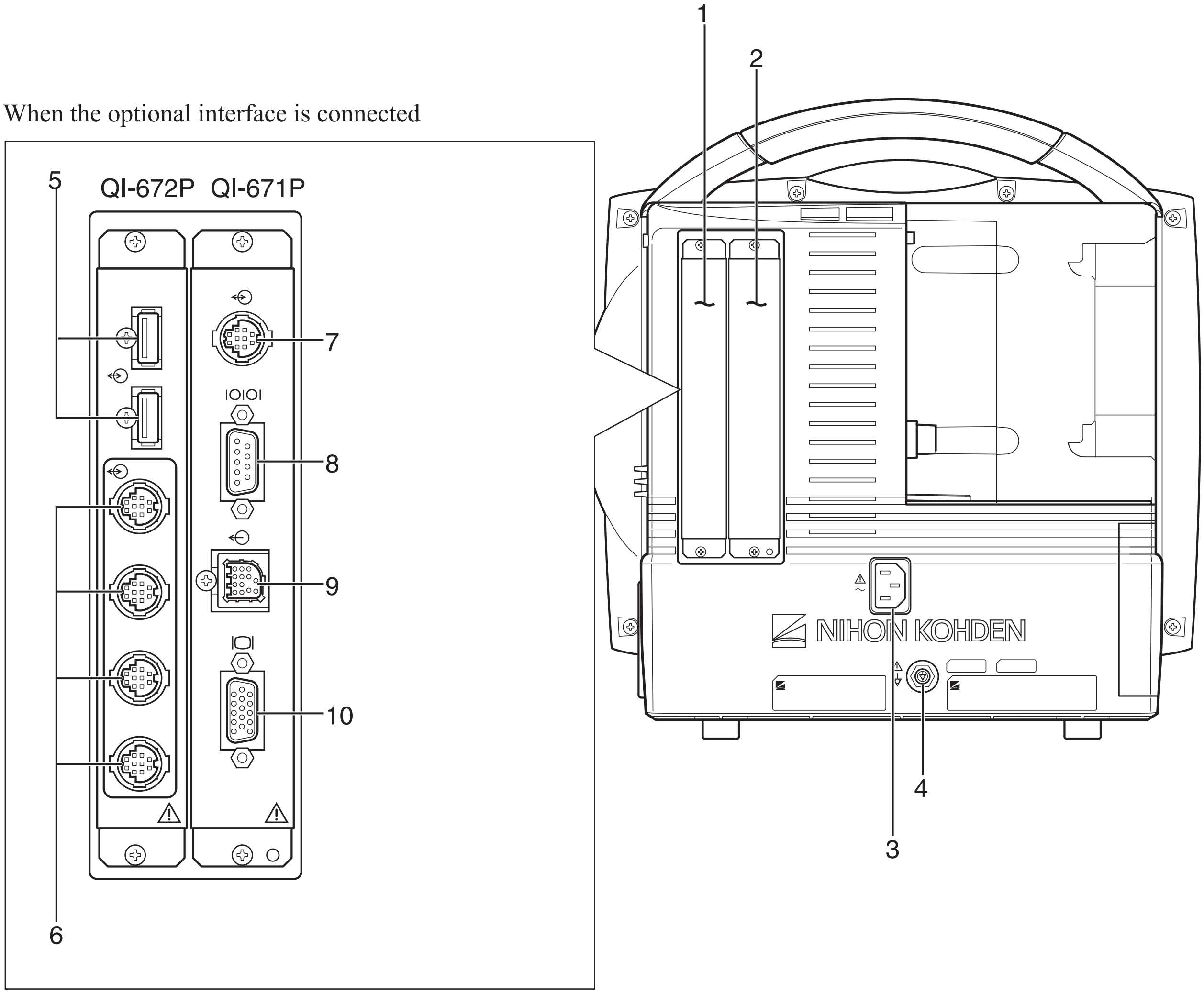
2 ZS socket
For the ZS-900P* transmitter.

*ZS-900P transmitter is not available for BSM-6000A series.

3 Network socket
Connects to monitor network system via the network separation unit.

4 Recorder module holder
For the WS-671P recorder module.

Rear Panel



When the optional interface is connected

1 QI-672P interface socket
Connects the QI-672P interface.

2 QI-671P interface socket
Connects the QI-671P interface.

3 AC SOURCE power cord socket
For the AC power cord.

4 Equipotential grounding terminal
For an equipotential grounding lead.

5 USB sockets
Connects a mouse or bar code reader.

6 Multi-link sockets
Connects a QF series interface or IF series communication cable.

7 Multi-link sockets
Connects a QF series interface or IF series communication cable.

8 RS-232C socket
Not available.

9 Alarm socket
Connects a YJ-672P nurse call cable.

10 RGB socket
Outputs the RGB video signal. Connects to the dual display or slave display.

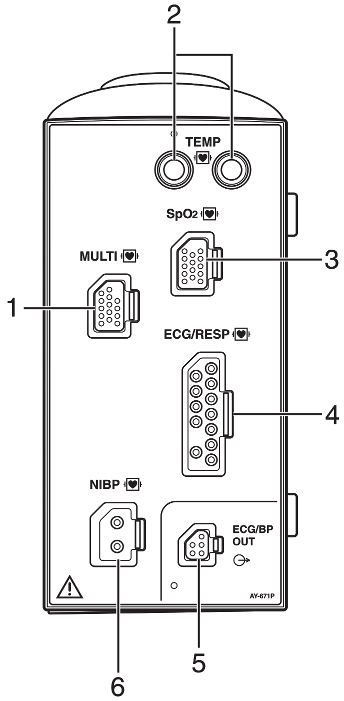
AY-631P/633P/651P/653P/660P/661P/663P/671P/673P Input Unit

AY-660P: One TEMP socket, one MULTI socket, no ECG/BP OUT socket
AY-631P/AY-651P/AY-661P/AY-671P: One MULTI socket
AY-633P/AY-653P/AY-663P/AY-673P: Three MULTI sockets

Front Panel

One MULTI socket

Example is AY-671P input unit.



NOTE

- AY-660P/AY-661P/AY-663P input units are not available for BSM-6000A series.
- With the MULTI socket on the AY-660P input unit, either IBP or CO_2 can be monitored.

1 MULTI socket
Connects to the connection cord of the parameter to be monitored (IBP, temperature, CO, CO_2, SpO_2-2 (AY-661P/AY-663P/AY-671P/AY-673P only), O_2, respiration by thermistor method or BIS). The type of parameter is automatically recognized.

2 TEMP socket
Connects to the temperature probe cord.

3 SpO_2 socket
Connects to the SpO_2 connection cord.

4 ECG/RESP socket
Connects to the ECG connection cord.

5 ECG/BP OUT socket
Outputs 100 mmHg/V IBP waveform of the IBP connected to the MULTI socket, 1 mV/V ECG waveform and heart rate trigger by using the YJ-910P or YJ-920P ECG/BP output cable. These analog signals can be used as the synchronization signal for other equipment, such as IABP.

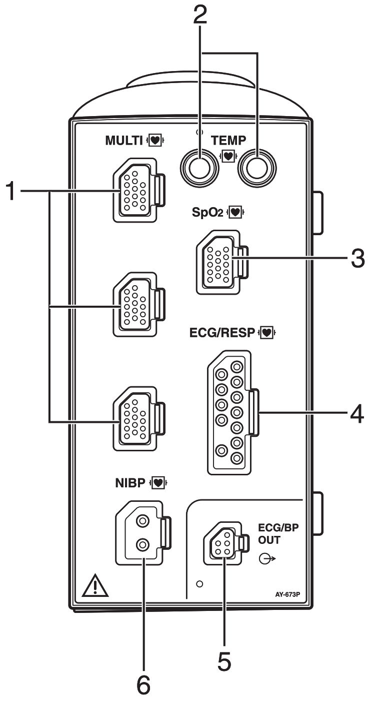
6 NIBP socket
Connects to the air hose.

WARNING

Connect only the specified instrument to the monitor and follow the specified procedure. Failure to follow this warning may result in electrical shock or injury to the patient and operator, and cause fire or instrument malfunction.

Three MULTI sockets

Example is AY-673P input unit.



Using MULTI Sockets for CO Monitoring

WARNING

When performing defibrillation during cardiac output monitoring, never touch the CO connection cord. The discharged energy may cause electrical shock or injury.

NOTE

CO monitoring using the MULTI socket does not comply with the defibrillator proof type CF.

Using the Output Signal from the ECG/BP OUT Socket

CAUTION

When using the output signal from the monitor as the synchronization signal for other equipment such as an IABP (intra-aortic balloon pump) or defibrillator:

- Set the timing of the IABP by checking the waveform on the IABP screen.
- Check the condition of the bedside monitor at all times. The output signal may become unstable.
- Check that the delay time of the output signal is within the range of the connected equipment.

CAUTION

Only a Nihon Kohden defibrillator can use the output signal from the monitor as a synchronization signal. Check that the delay time of the output signal (heart rate trigger 20 ms maximum) is within the range of the connected defibrillator.

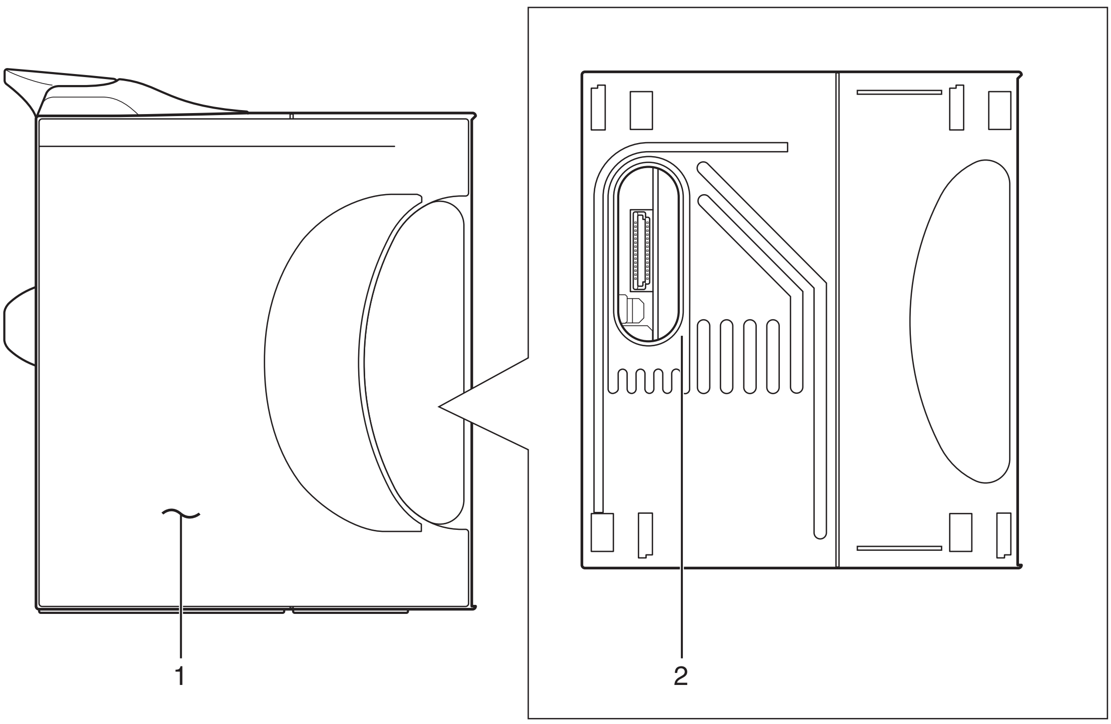
NOTE

- When using an IBP waveform as a synchronization signal for other equipment, connect the IBP line to the MULTI socket on the input unit. The IBP waveform that is used for the synchronization signal depends on the “IBP ANALOG OUT” setting in the SYSTEM SETUP window.
  - When “IBP ANALOG OUT” is set to “FIXED POSITION”: The IBP line connected to the top MULTI socket on the input unit is used.
  - When “IBP ANALOG OUT” is set to “HIGHEST PRIORITY LABEL”: When more than one IBP waveform is acquired, the IBP waveform of the highest priority label is used.
    IBP label priority:
    ART > ART2 > RAD > DORS > AO > FEM > UA > LVP > P1 > P2 > P3 > P4 > P5 > P6 > P7
- The output signal from the ECG/BP OUT socket may become unstable in the following conditions.
  - Electrode is dry or detached.
  - Electrode lead is damaged or disconnected from the electrode.
  - Electrode lead is pulled.
  - AC interference or EMG noise superimposed.
  - Air bubbles or blood clog in the circuit for monitoring IBP.
  - Cord or cable is disconnected or damaged.
- All instruments which are to be connected to the ECG/BP OUTPUT socket must use a YJ-910P or YJ-920P ECG/BP output cable and comply with the IEC 60601-1 safety standard for medical equipment.
- When using an IABP, set <CALCULATION METHOD> on the OTHER page of the PRESS window to “PEAK” to improve measurement accuracy.

Output Signal Delay Time

Output Signal	Delay Time
ECG	maximum 20 ms
IBP	maximum 40 ms
Heart rate trigger	maximum 20 ms

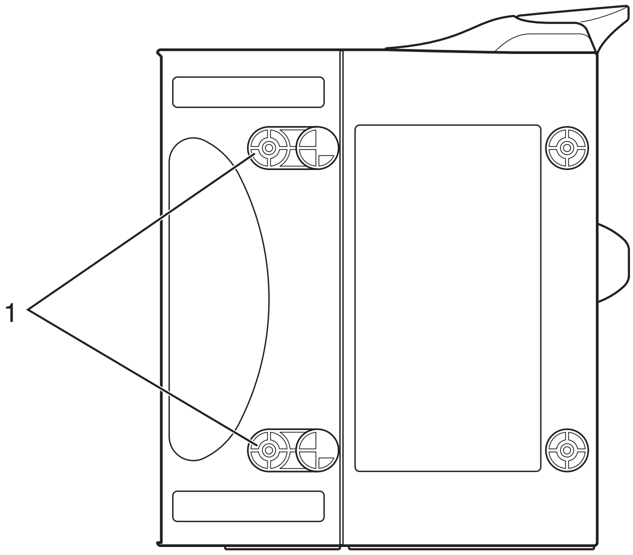
Left Side Panel


When the side panel is removed

1 Side panel
Remove to attach an AA-672P/AA-674P smart expansion unit.

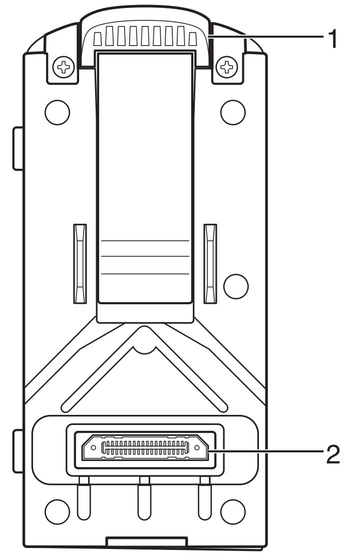
2 Smart expansion unit socket
Connects an AA-672P/AA-674P smart expansion unit.

Right Side Panel



1 Tabs
Match the tabs on the input unit to the slots on the bedside monitor.

Rear Panel



1 Lock release lever

Lift up the lever to remove the input unit from the bedside monitor.

2 Input unit socket

For connecting a bedside monitor.

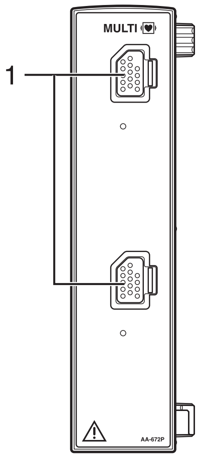
AA-672P/AA-674P Smart Expansion Unit

NOTE

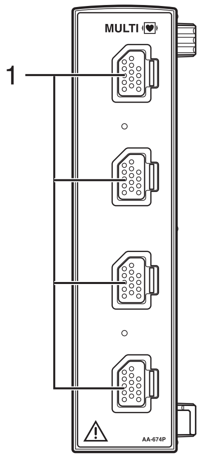
AA-672P/674P smart expansion unit cannot be used with AY-660P input unit.

Front Panel

AA-672P



AA-674P



1 MULTI socket

Connect to the connection cord of the parameter to be monitored (Respiration by thermistor method, CO_2, SpO_2-2 (only when AY-661P/AY-663P/AY-671P/AY-673P input unit is used), IBP, temperature, CO, O_2 or BIS). The type of parameter is automatically recognized.

Using MULTI Sockets for CO Monitoring

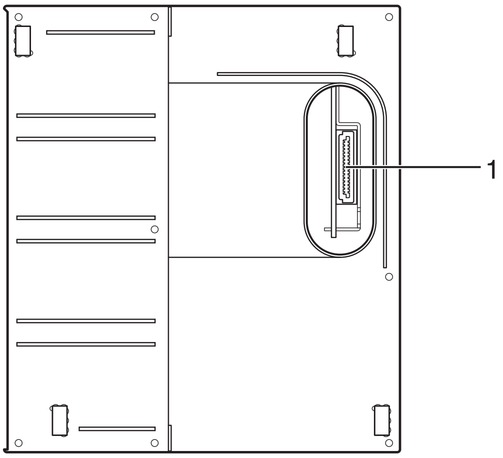
WARNING

When performing defibrillation during cardiac output monitoring, never touch the CO connection cord. The discharged energy may cause electrical shock or injury.

NOTE

CO monitoring using the MULTI socket does not comply with the defibrillator proof type CF.

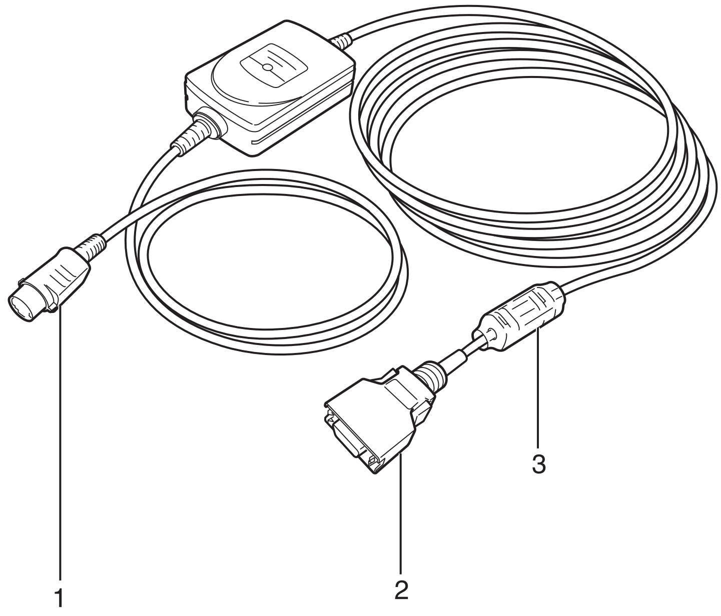
Right Side Panel



1 Connector

Connects an AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P or AY-673P input unit.

QF series Interface and IF series Communication Cable

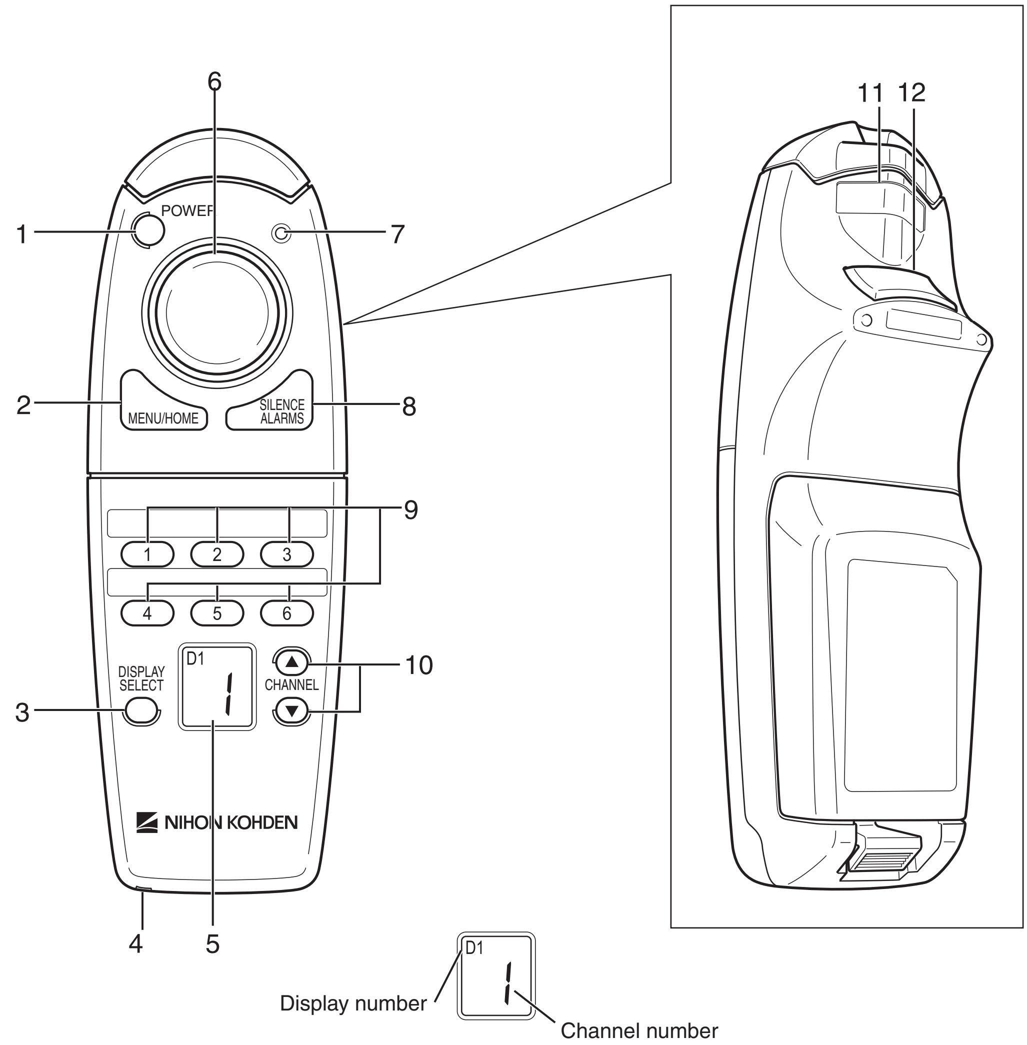


1 Multi-link connector
Connect to the multi-link socket on the bedside monitor.

2 External device connector
Connect to an external device.

3 Ferrite core

RY-910PA Remote Controller


6
11 12
1
POWER
7
2
MENU/HOME
SILENCE ALARMS
8
9
1
2
3
4
5
6
10
DISPLAY SELECT
D1
1
CHANNEL
3
NIHON KOHDEN
4
5
D1
1
Display number
Channel number

1 POWER button
When the power cord is connected between the bedside monitor and AC outlet, turns the monitor power on or off.

2 MENU/HOME key
Opens the MENU window. Closes the window and displays the home screen when a window is opened.

3 DISPLAY SELECT key
Not available.

4 Strap hole
Use a strap to prevent dropping the remote control.

5 Display
Displays the channel number and the display number.

6 Selection knob
Move this knob up/down/left/right to move the cursor or mouse pointer on the screen.

7 LED
Lights when the pointer on the screen is moved by the selection knob. Blinks when a key on the remote control is pressed.

8 SILENCE ALARMS key
Silences the alarm sound.

9 Customized keys
Windows and functions can be assigned to each key for shortcut key operations.

10 CHANNEL keys
Select the monitor when a channel is assigned to the monitor.

11 Transmitter
Signal is transmitted from here. Point the transmitter to the remote control sensor on the bedside monitor when operating the monitor with the remote control.

12 ENTER key
Registers the setting selected on the screen.

Storage and Transport

Follow these procedures when storing or transporting the monitor.

Storage

Before storing the monitor for a long time, perform the following steps:

1. Disconnect the power cord from the monitor.
2. Cover the monitor with a dust cover.
3. If possible, store the monitor in its original shipping container.
4. Make sure the storage place meets the following storage conditions for the duration of the storage.
   Storage temperature: −20 to +65°C (−4 to +149°F)
   Storage humidity: 10 to 95% RH

Transport

To transport the monitor, perform the following steps:

1. Disconnect the power cord from the monitor.
2. Cover the monitor with a dust cover.
3. If possible, transport the monitor in its original shipping container. Following transport conditions are required.
   Transport temperature: −20 to +65°C (−4 to +149°F)
   Transport humidity: 10 to 95% RH

Hard Keys and Soft Keys

Hard Keys

The monitor has six hard keys: Silence Alarms, NIBP Interval, NIBP Start/Stop, Menu, Home and Record. These keys always have the same functions, regardless of the screen display.

Soft Keys

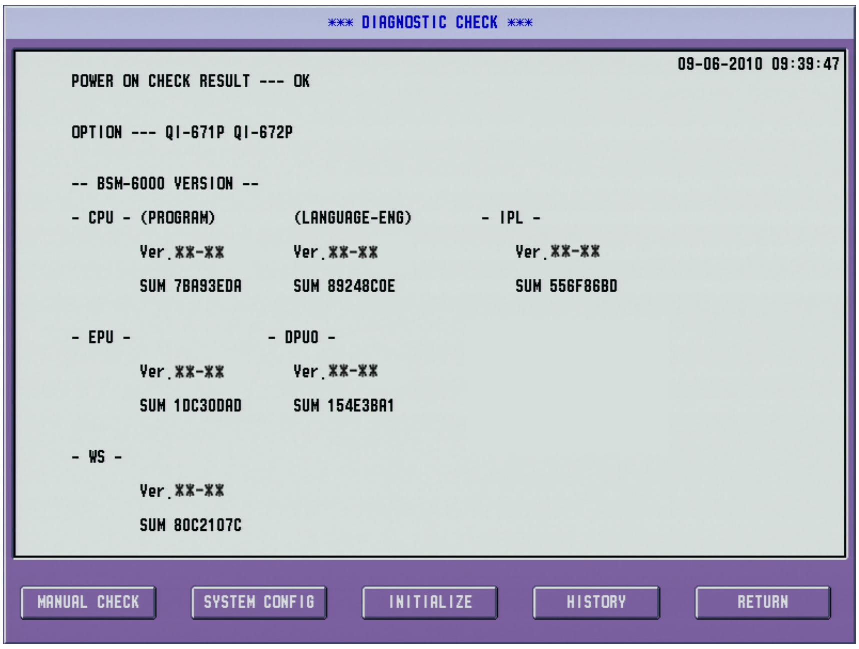
When the Menu key is pressed or the screen is touched, the screen displays several keys which have different functions depending on the screen display. For example, when the HR numeric display is touched, the ECG setting screen appears and several tabs such as ST ALARMS, ARRHYTH, OTHER, etc are displayed.

Maintenance and Software

Password

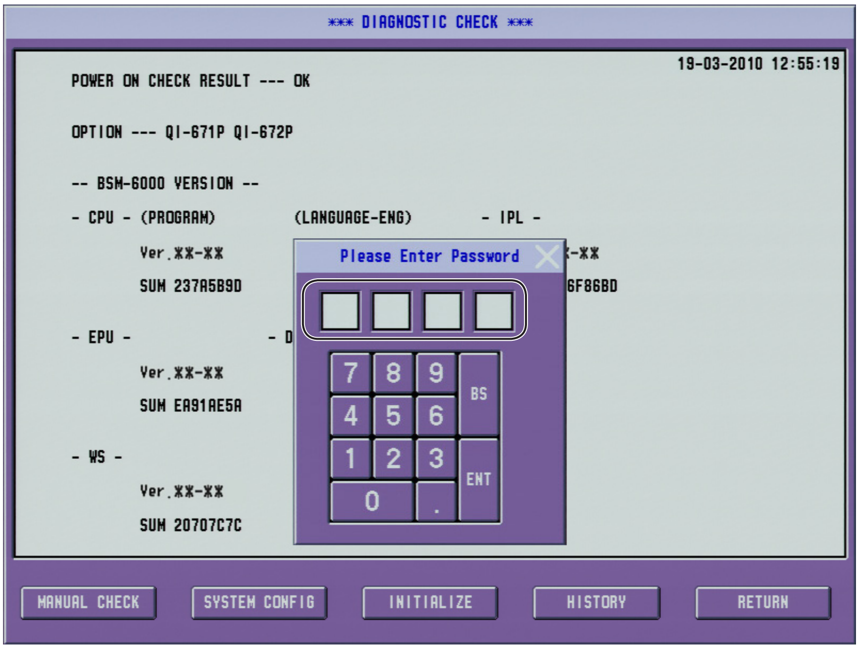
A password is necessary to enter the MANUAL CHECK screen, SYSTEM CONFIGURATION screen, HISTORY screen and SYSTEM SETUP window. (The password is set to "1234" by factory default.) To enter the relevant screen without using the password ("1234" by factory default), enter the current time as the password (for example, if the current time is 10:46, enter "1046").

The MANUAL CHECK screen, SYSTEM CONFIGURATION screen and HISTORY screen can be accessed from the DIAGNOSTIC CHECK screen. The DIAGNOSTIC CHECK screen can be opened by pressing the [Power] switch while holding the [Silence Alarms] key.



```
*** DIAGNOSTIC CHECK ***
                                                                09-06-2010 09:39:47
    POWER ON CHECK RESULT --- OK

    OPTION --- QI-671P QI-672P

    -- BSM-6000 VERSION --
    - CPU - (PROGRAM)        (LANGUAGE-ENG)        - IPL -
            Ver.XX-XX        Ver.XX-XX                 Ver.XX-XX
            SUM 7BA93EDA     SUM 89248C0E              SUM 556F86BD

    - EPU -                - DPU0 -
            Ver.XX-XX        Ver.XX-XX
            SUM 1DC30DAD     SUM 154E3BA1

    - WS -
            Ver.XX-XX
            SUM 80C2107C
```

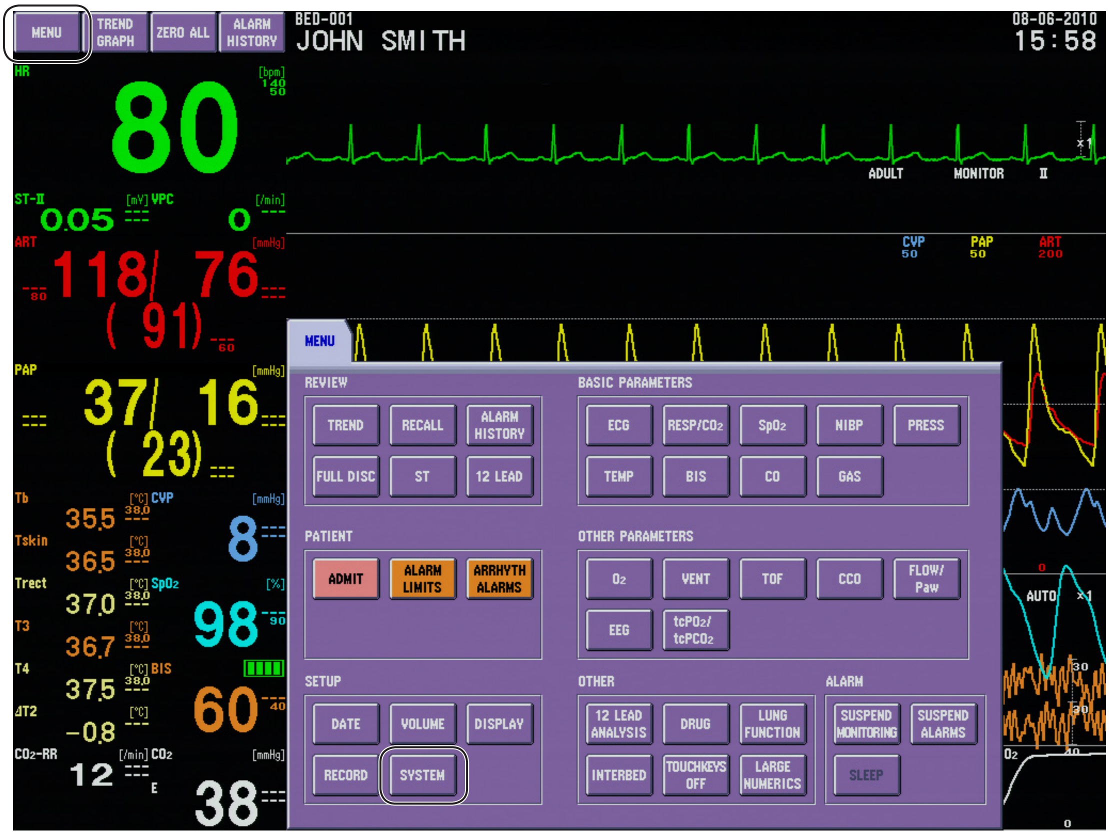
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

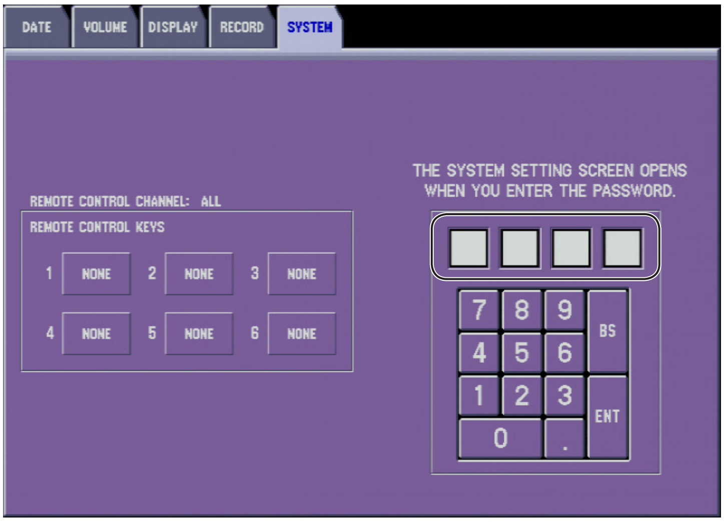


```
*** DIAGNOSTIC CHECK ***
                                                                19-03-2010 12:55:19
    POWER ON CHECK RESULT --- OK

    OPTION --- QI-671P QI-672P

    -- BSM-6000 VERSION --
    - CPU - (PROGRAM)        (LANGUAGE-ENG)        - IPL -
            Ver.XX-XX                              -XX
            SUM 237A5B9D                           6F86BD

    - EPU -                - D
            Ver.XX-XX
            SUM EA91AE5A

    - WS -
            Ver.XX-XX
            SUM 20707C7C
```

Please Enter Password
7
8
9
BS
4
5
6
1
2
3
ENT
0
.
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

The SYSTEM SETUP window can be accessed from the MENU window.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
08-06-2010
15:58
HR
80
ST-II 0.05
VPC 0
ART 118/ 76 (91)
PAP 37/ 16 (23)
Tb 35.5
Tskin 36.5
Trect 37.0
T3 36.7
T4 37.5
ΔT2 -0.8
CO2-RR 12
CVP 8
SpO2 98
BIS 60
CO2 38
ADULT
MONITOR
II
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
SETUP
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
OTHER
12 LEAD ANALYSIS
DRUG
LUNG FUNCTION
INTERBED
TOUCHKEYS OFF
LARGE NUMERICS
ALARM
SUSPEND MONITORING
SUSPEND ALARMS
SLEEP


DATE
VOLUME
DISPLAY
RECORD
SYSTEM
REMOTE CONTROL KEYS
7 8 9
4 5 6
1 2 3
0 .
BS
ENT

REMOTE CONTROL CHANNEL: ALL

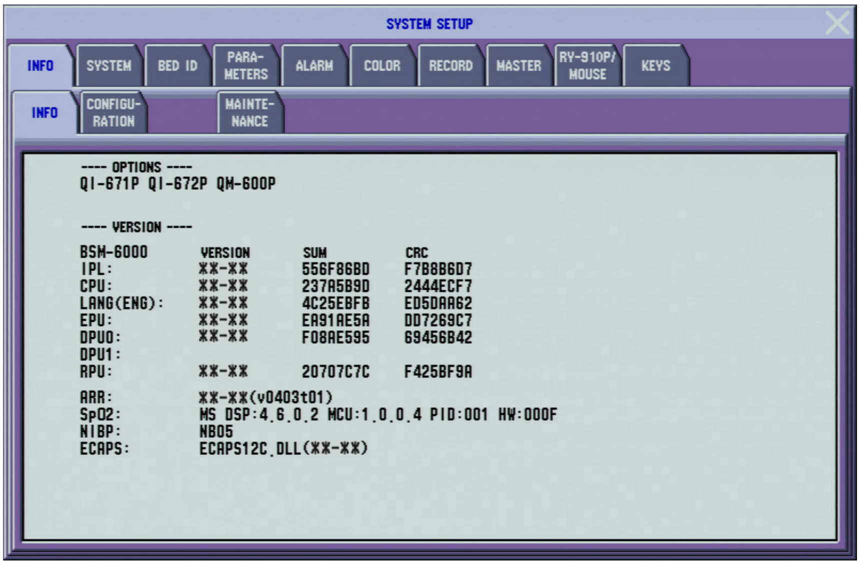
1 NONE
2 NONE
3 NONE
4 NONE
5 NONE
6 NONE

THE SYSTEM SETTING SCREEN OPENS WHEN YOU ENTER THE PASSWORD.

Checking Software Version

Checking on the SYSTEM SETUP Window

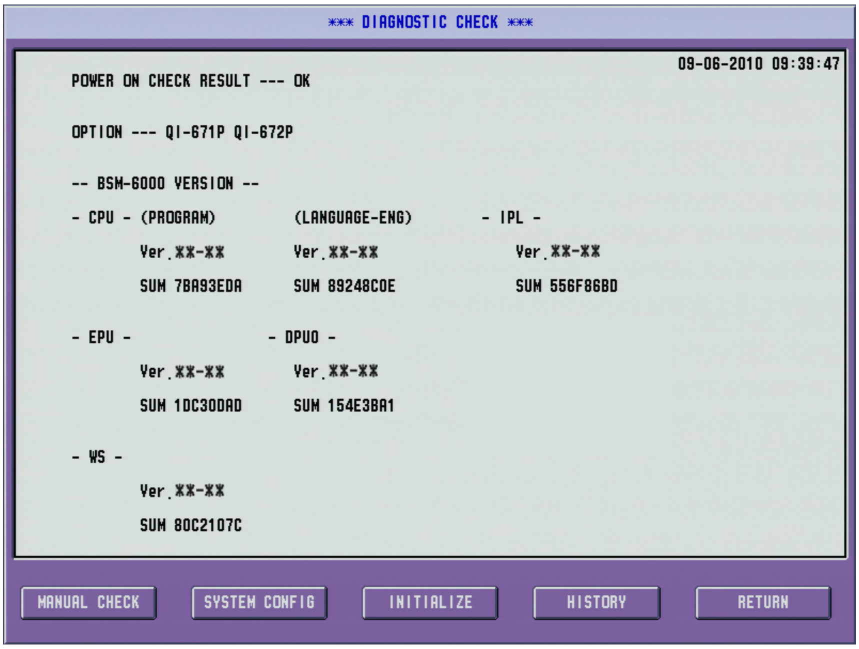
Select SYSTEM in the MENU window and enter the password. The following information window is displayed. In this information window, versions of each software described in the “Software Composition” section can be checked.


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE

```
---- OPTIONS ----
QI-671P QI-672P QM-600P

---- VERSION ----
BSM-6000       VERSION     SUM        CRC
IPL:           **-**       556F86BD   F7B8B6D7
CPU:           **-**       237A5B9D   2444ECF7
LANG(ENG):     **-**       4C25EBFB   ED5DAA62
EPU:           **-**       EA91AE5A   DD7269C7
DPU0:          **-**       F08AE595   69456B42
DPU1:
RPU:           **-**       20707C7C   F425BF9A

ARR:           **-**(v0403t01)
SpO2:          MS DSP:4.6.0.2 MCU:1.0.0.4 PID:001 HW:000F
NIBP:          NB05
ECAPS:         ECAPS12C.DLL(**-**)
```

Checking on the DIAGNOSTIC CHECK Screen

Turn on the power while holding the [Silence Alarms] key.


*** DIAGNOSTIC CHECK ***
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

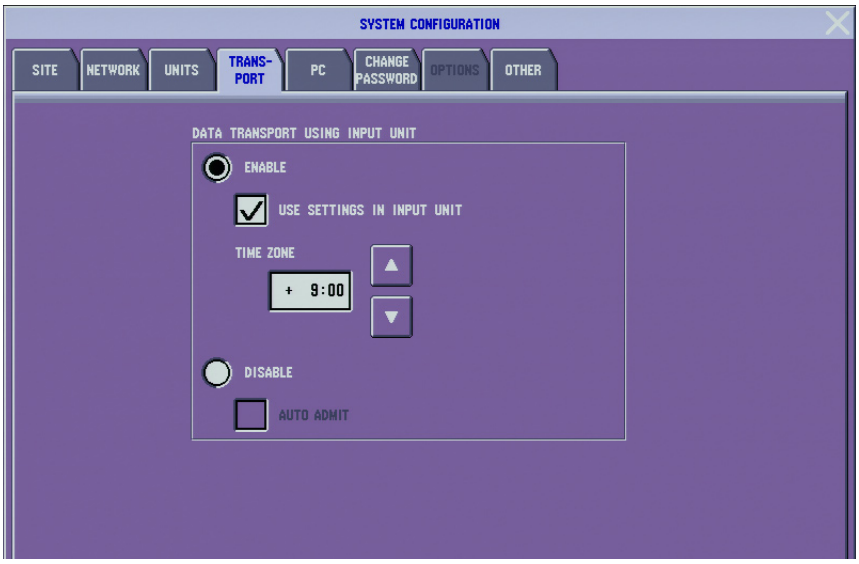
```
                                                      09-06-2010 09:39:47
  POWER ON CHECK RESULT --- OK

  OPTION --- QI-671P QI-672P

  -- BSM-6000 VERSION --

  - CPU - (PROGRAM)      (LANGUAGE-ENG)      - IPL -

          Ver.**-**      Ver.**-**              Ver.**-**

          SUM 7BA93EDA   SUM 89248C0E           SUM 556F86BD

  - EPU -              - DPU0 -

          Ver.**-**      Ver.**-**

          SUM 1DC30DAD   SUM 154E3BA1

  - WS -

          Ver.**-**

          SUM 80C2107C
```

AUTO ADMIT Setting

In BSM-6000 series, a patient's admit data and measurement data is erased when <AUTO ADMIT> in the SYSTEM CONFIGURATION screen is set to ON and 30 minutes passes after the power is turned off. In a maintenance operation, if settings and a patient's data are to be retained after the power is turned off, set <AUTO ADMIT> to OFF in advance.

Displaying the TRANSPORT page of the SYSTEM SETUP Window

When <DATA TRANSPORT USING INPUT UNIT> is set to DISABLE, uncheck <AUTO ADMIT>. When it is set to ENABLE, <AUTO ADMIT> function is fixed to OFF.



DATA TRANSPORT USING INPUT UNIT

● ENABLE

☑ USE SETTINGS IN INPUT UNIT

TIME ZONE + 9:00

○ DISABLE

☐ AUTO ADMIT

Setting Automatic Admit

This sets whether or not a patient's admit data and measurement data is to be automatically erased when 30 minutes passes after the power is turned off.

Setting:

ON (checked):	A patient's admit data and measurement data are erased and settings are initialized when 30 minutes passes after the power is turned off, and a new monitoring of another patient is started. When the power is turned on within 30 minutes after turning off the power, the recent patient's measurement data is successively displayed.
OFF (unchecked):	When the power is turned on, regardless of the time elapsed since the last power-off, a confirmation message appears. When you touch YES, a patient's admit data and measurement data are erased and settings are initialized. Then a new monitoring of another patient is started. When you touch NO, the recent patient's measurement data is successively displayed.

Backup of Data and Settings

Back up the system settings and environmental settings before performing a periodic inspection or a repair operation in order to restore the settings after the operation.

Locations Where Data and Settings are Stored

Writing Locations	Write Details
Internal SD card	Review Data (Trends, Tabular trend, NIBP tabular trend, Alarm history, Full disclosure waveforms, Arrhythmia recall)
FRAM on MAIN DIGITAL board	Settings other than review data (Network settings, Interbed settings, Passwords, Error history, Alarm settings, Patient information, etc.)

Notes on Saving and Initialization of Data and Settings

Be aware that when performing maintenance operation, some data and settings are to be initialized. Save (back up) data before performing maintenance operation and load (restore) it after maintenance operation as necessary.

Notes in each maintenance type are explained below.

- In system initialization
- In replacement of units or parts
- In replacement with alternate monitor (when making same settings for multiple monitors)
- In upgrade or downgrade
- In maintenance operation of monitor for which the transport function is activated

Notes in system initialization

There are three ways of system initialization: Initialization by general password, Initialization by administrator password and Initialization to reset to factory default. The range to be initialized differs depending on the initialization method. Among the data listed in the above “Locations Where Data and Settings are Stored”, data types that are initialized when the system is initialized are shown in the following table. Also, among those data, data types that can be saved into an internal or external SD card are shown.

Before performing a system initialization, understand the following tables and back up data by following the procedures in “Saving/Loading Settings” as necessary.

Refer to “System Initialization” for details.

NOTE

When initializing a monitor in which the transport function is activated, note the following to retain data in a memory unit of the input unit: Remove the input unit once from the main unit before performing a system initialization. After the system initialization is completed, activate the transport function in the system details screen, and then reconnect the input unit to the main unit.

Methods of System Initialization	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
General password	Initialized	Initialized	Initialized	Not initialized	Initialized	Not initialized	Not initialized
Administrator password	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Not initialized
Factory initialization	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized

Media	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
Internal SD card	Impossible	Possible	Impossible	Impossible	Possible	Possible	Impossible
Optional SD card	Impossible	Possible	Impossible	Impossible	Impossible	Possible	Impossible

Notes in replacement of units or parts

Be aware that when performing maintenance operation, some settings or review data are lost depending on the unit or part to be replaced. Items which are lost in replacement of respective units or parts are shown below.

	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History	Date and Time
In MAIN DIGITAL board replacement	Lost	Lost	Lost	Lost	Lost	Lost	Lost	Lost
In internal SD card replacement	Lost	Retained	Retained	Retained	Retained	Retained	Retained	Retained
In lithium battery replacement	Lost	Retained	Retained	Retained	Retained	Retained	Retained	Lost

NOTE

- When the MAIN DIGITAL board is replaced, all data are erased. If the MAIN DIGITAL board data can be output before replacing the board, be sure to output the settings in the MAIN DIGITAL board to the internal SD card. The settings can be restored after replacement by connecting the same memory card to the new MAIN DIGITAL board and loading the saved data (for details on loading data, refer to “Saving/Loading Settings” in this section).
- On the MAIN DIGITAL board, a dip switch is mounted for identifying the hardware revision. When replacing the MAIN DIGITAL board, be sure to check the dip switch setting (for details, refer to “Dip Switch (SW201) Settings” in Section 5).
- After replacing the internal SD card, be sure to perform the discharge operation to delete the review data. Refer to the operator’s manual for details.
- When replacing a monitor in which the transport function is activated with an alternate monitor, note the following to retain data in a memory unit of the input unit: Be sure to activate the transport function of the

alternate monitor in the SYSTEM SETUP window before connecting the input unit to the alternate monitor.

Notes on replacement with alternate monitor

Procedures of replacement with alternate monitor

1. Save the monitor's user settings into an optional SD card. Refer to the "Saving/Loading Settings" on the next page for details.

2. For the following items, which are not to be saved into an optional SD card, write them down.
   - Patient information
   - Network settings
   - Interbed settings
   - Date and time

3. Previous user's settings may be left in the alternate monitor. Therefore execute the administrator initialization on the alternate monitor.

4. Load the settings saved in the optional SD card into the alternate monitor.

5. Manually set the items that have been written down in step 2 on the alternate monitor.

Notes on replacement with alternate monitor

- Only an optional SD card can be used for moving set data.
- Set data and review data cannot be moved by re-installing the user's memory card into the alternate monitor.
- Moving set data by using an optional SD card is possible only between the same models and same versions. Do not move set data between different models or different versions.
- The user monitor and the alternate monitor must be the same in their version numbers.

Notes in upgrade or downgrade

Settings and data are initialized when the system is initialized. Therefore, be sure to save the settings and data into the internal SD card before executing an upgrade. After executing an upgrade or downgrade, perform a system initialization. After that, load the settings from the internal SD card.

NOTE

- In a downgrade operation, do not perform reading/loading of settings.
- For newly added items by an upgrade, their factory values are set.
- For deleted items by an upgrade, their values are ignored.
- In the future, compatibility among MU-631R/651R/671R main unit, AY-600P series input unit and AA-672P/674P smart expansion unit may be ensured. Therefore, check the maintenance information in advance especially when executing an upgrade or downgrade for only one of them.

In maintenance operation of monitor for which the transport function is activated

To retain the patient’s data and set data in the input unit until after a maintenance operation of a monitor in which the transport function is activated, note the following:
If connecting the input unit to a monitor in which the transport function is inactivated and starting monitoring, or if the monitor is started while the input unit is connected, data in a memory unit of the input unit is initialized. The transport function is deactivated by default. Therefore when the system is initialized, remove the input unit once, and execute the system initialization, and activate the transport function, and then connect the input unit. When replacing the monitor with an alternate monitor, be sure to activate the transport function of the alternate monitor before connecting the input unit.

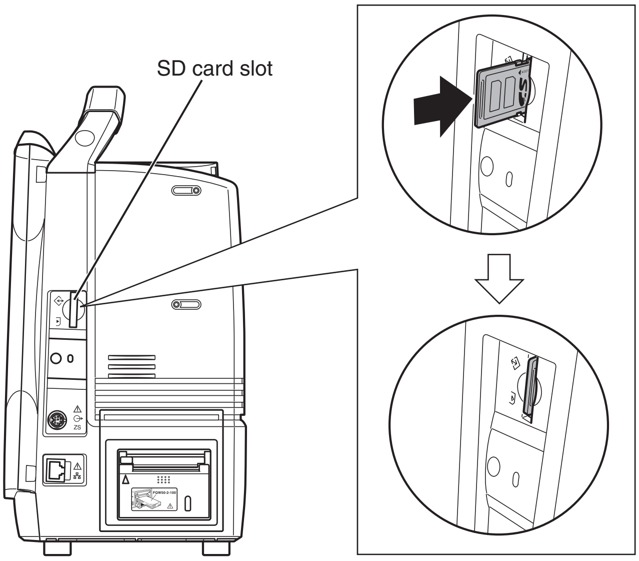
Saving/Loading Settings

Settings can be saved to the internal memory card or an optional SD card. However, review data cannot be saved. For settings and data that can be saved, refer to “Notes on Saving and Initialization of Data and Settings”.

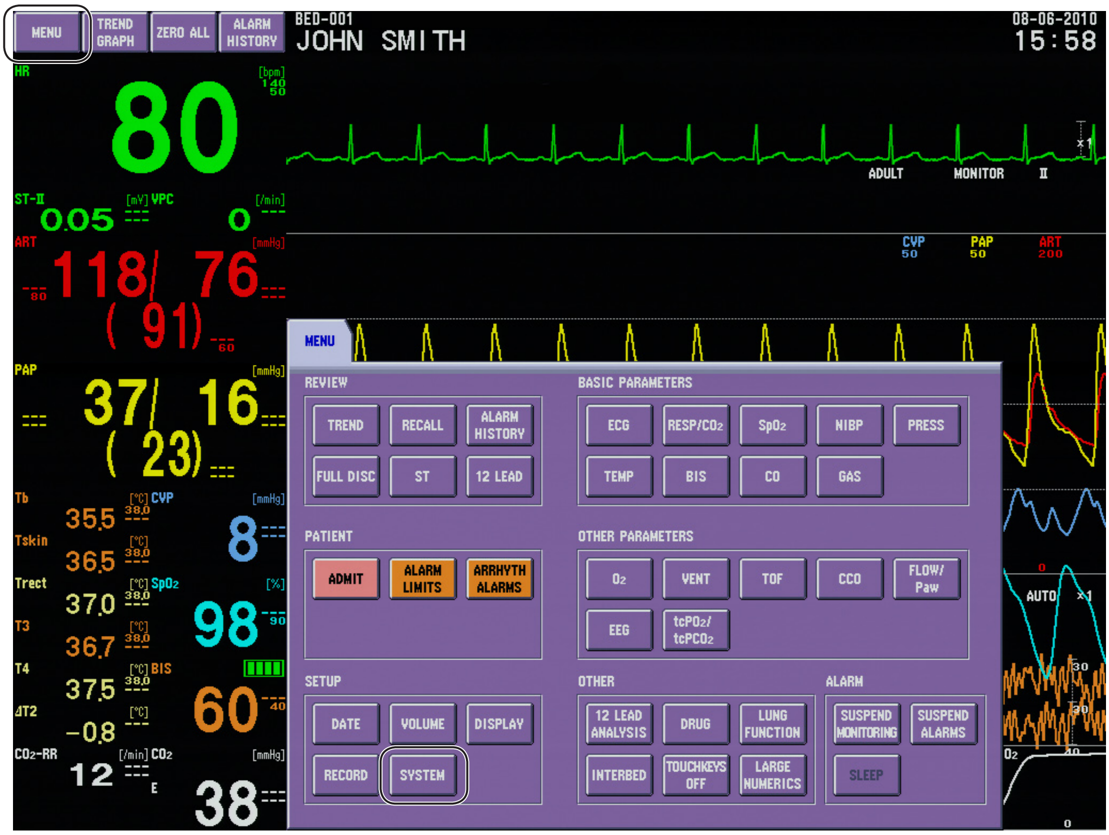
Note that moving the settings and data by using an optional SD card is possible only between the monitors with the same models and same versions. Do not move the settings and data to a monitor with a different model or different version.

SD card usable for optional SD card slot
- SD card 256 MB: Part code 926767
- SD card 128 MB: Part code 919552

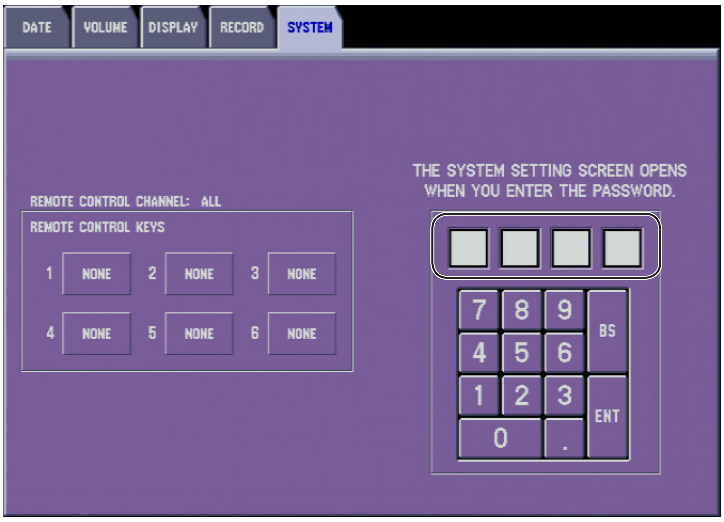
NOTE
We cannot guarantee proper operation for other SD cards.



1. Touch the MENU key and select SYSTEM.

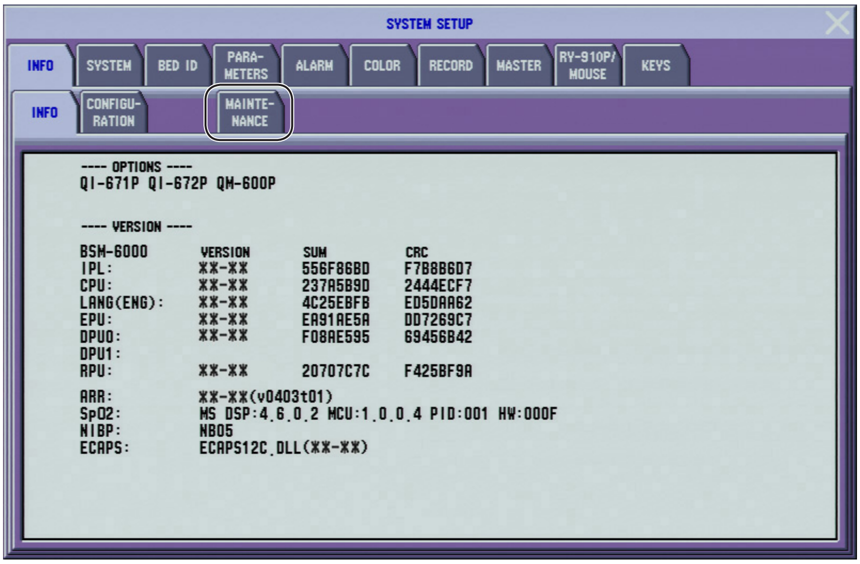

MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
08-06-2010
15:58
MENU
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
SETUP
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
OTHER
12 LEAD ANALYSIS
DRUG
LUNG FUNCTION
INTERBED
TOUCHKEYS OFF
LARGE NUMERICS
ALARM
SUSPEND MONITORING
SUSPEND ALARMS
SLEEP

2. Enter the password.


DATE
VOLUME
DISPLAY
RECORD
SYSTEM
REMOTE CONTROL CHANNEL: ALL
REMOTE CONTROL KEYS
1 NONE
2 NONE
3 NONE
4 NONE
5 NONE
6 NONE
7 8 9
4 5 6
1 2 3
0 .
BS
ENT

THE SYSTEM SETTING SCREEN OPENS WHEN YOU ENTER THE PASSWORD.

3. Touch the INFO → MAINTENANCE tab.

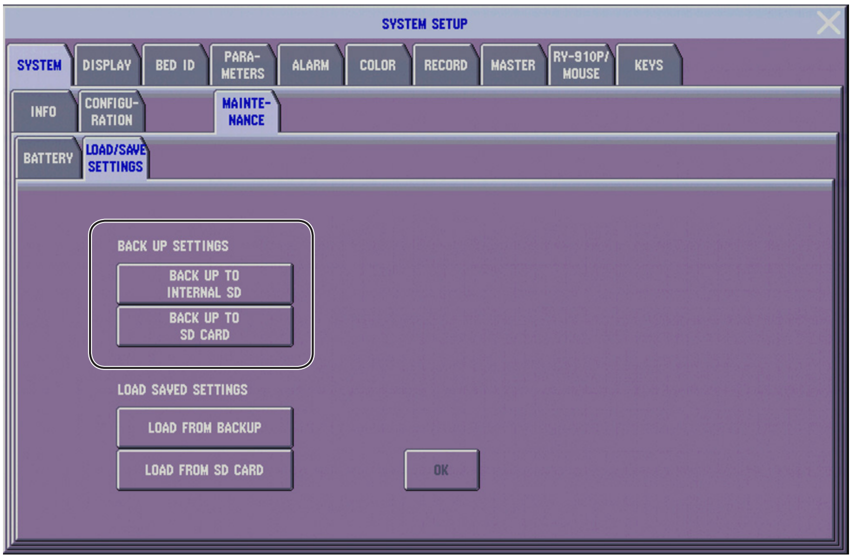

SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE

```
---- OPTIONS ----
QI-671P QI-672P QM-600P

---- VERSION ----
BSM-6000       VERSION     SUM         CRC
IPL:           **-**       556F86BD    F7B8B6D7
CPU:           **-**       237A5B9D    2444ECF7
LANG(ENG):     **-**       4C25EBFB    ED5DAA62
EPU:           **-**       EA91AE5A    DD7269C7
DPU0:          **-**       F08AE595    69456B42
DPU1:
RPU:           **-**       20707C7C    F425BF9A
ARR:           **-**(v0403t01)
SpO2:          MS DSP:4.6.0.2 MCU:1.0.0.4 PID:001 HW:000F
NIBP:          NB05
ECAPS:         ECAPS12C.DLL(**-**)
```

4. Select BACK UP TO INTERNAL SD or BACK UP TO SD CARD in <BACK UP SETTINGS>.

   When BACK UP TO INTERNAL SD is selected, settings are saved to the internal SD card.

   When BACK UP TO SD CARD is selected, settings are saved to an optional SD card inserted into the slot.

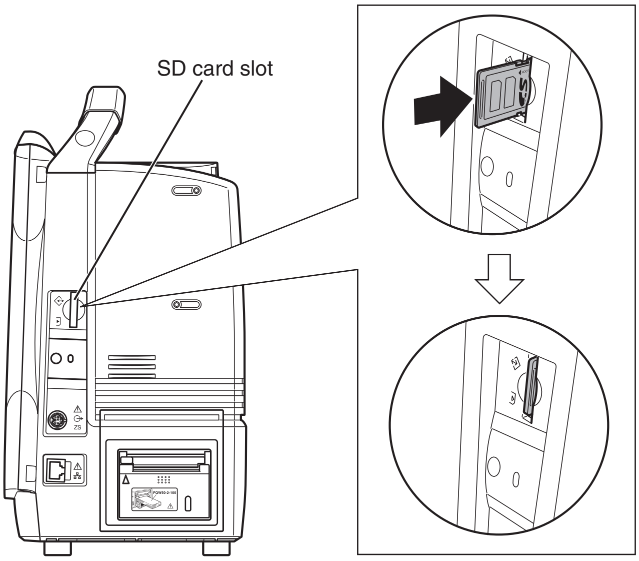

SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS
BACK UP SETTINGS
BACK UP TO INTERNAL SD
BACK UP TO SD CARD
LOAD SAVED SETTINGS
LOAD FROM BACKUP
LOAD FROM SD CARD
OK

CAUTION

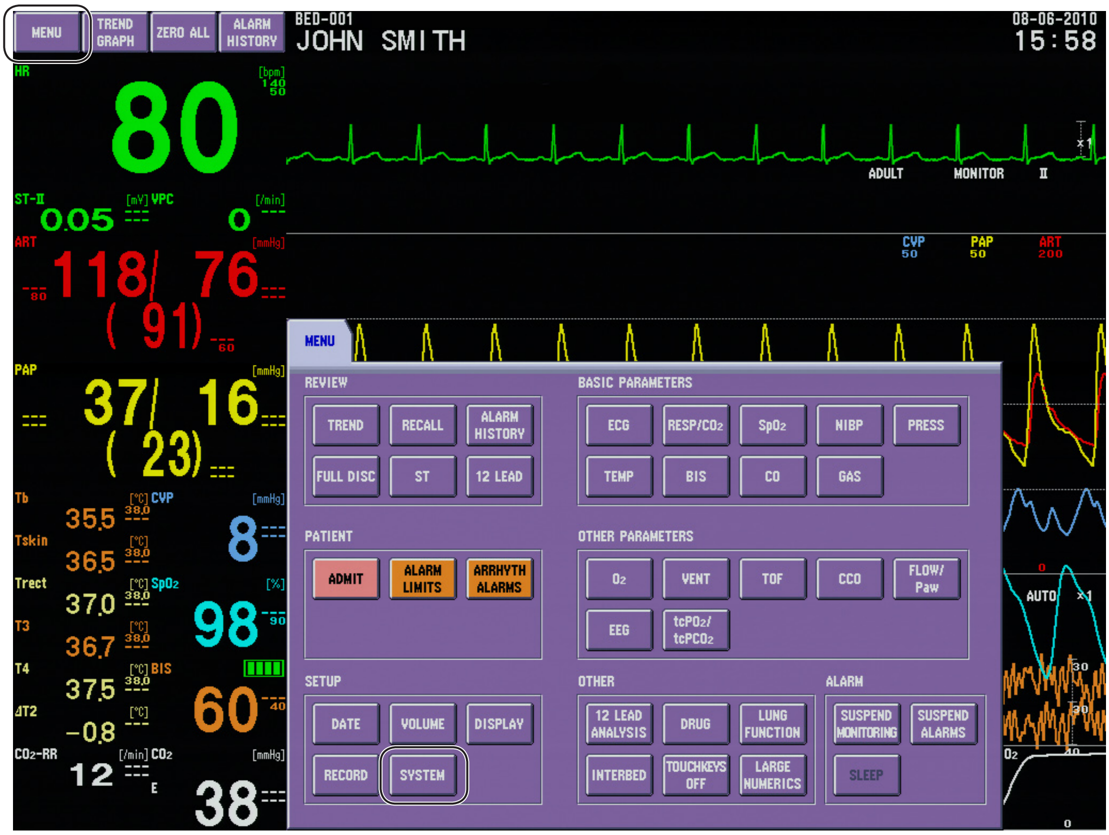
Do not turn off the power or remove the SD card while data is being saved.

Loading procedures

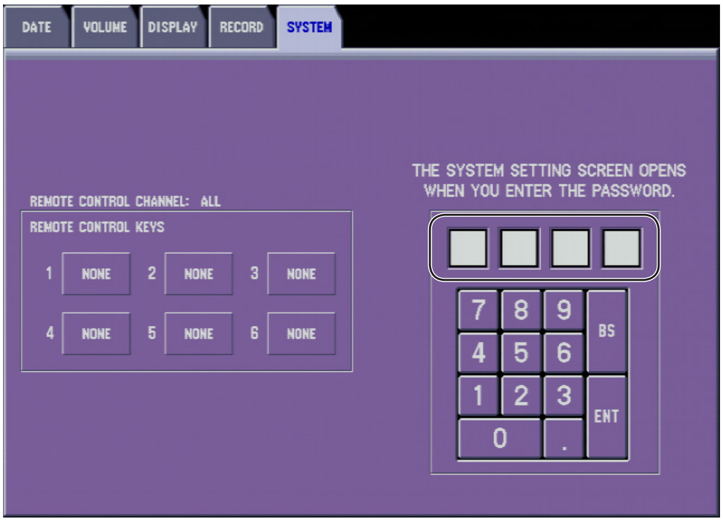
1. Insert the SD card in which the settings are saved into the SD card slot.


SD card slot

2. Touch the MENU key and select SYSTEM.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
08-06-2010
15:58
HR
80
ST-II 0.05
VPC 0
ART
118/ 76
(91)
PAP
37/ 16
(23)
Tb 35.5
Tskin 36.5
Trect 37.0
T3 36.7
T4 37.5
ΔT2 -0.8
CO2-RR 12
CVP 8
SpO2 98
BIS 60
CO2 38
ADULT
MONITOR
II
CVP 50
PAP 50
ART 200
AUTO
MENU
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
SETUP
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
OTHER
12 LEAD ANALYSIS
DRUG
LUNG FUNCTION
INTERBED
TOUCHKEYS OFF
LARGE NUMERICS
ALARM
SUSPEND MONITORING
SUSPEND ALARMS
SLEEP

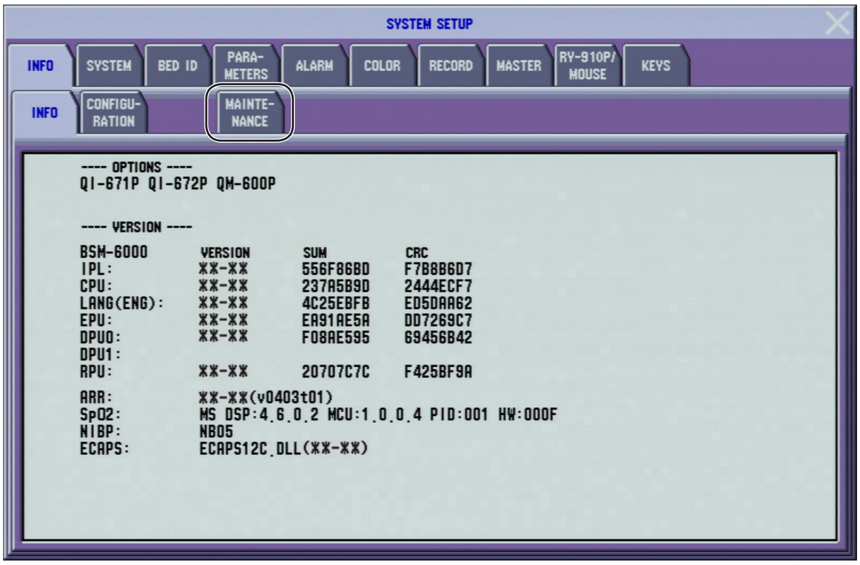
3. Enter the password.


DATE
VOLUME
DISPLAY
RECORD
SYSTEM
REMOTE CONTROL KEYS
1 NONE
2 NONE
3 NONE
4 NONE
5 NONE
6 NONE
7
8
9
BS
4
5
6
1
2
3
ENT
0
.

REMOTE CONTROL CHANNEL: ALL

THE SYSTEM SETTING SCREEN OPENS WHEN YOU ENTER THE PASSWORD.

4. Select MAINTENANCE.

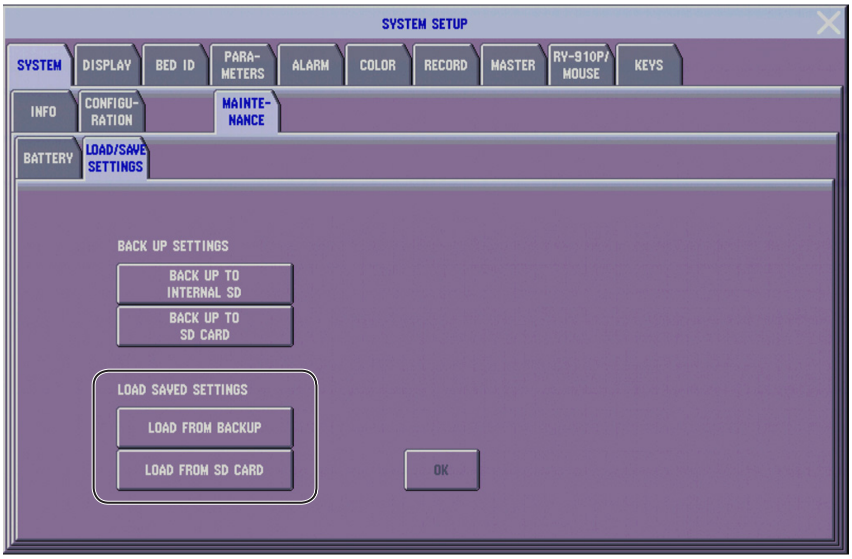

SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/ MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE

```
---- OPTIONS ----
QI-671P QI-672P QM-600P

---- VERSION ----
BSM-6000       VERSION        SUM         CRC
IPL:           XX-XX          556F86BD    F7B8B6D7
CPU:           XX-XX          237A5B9D    2444ECF7
LANG(ENG):     XX-XX          4C25EBFB    ED5DAA62
EPU:           XX-XX          EA91AE5A    DD7269C7
DPU0:          XX-XX          F08AE595    69456B42
DPU1:
RPU:           XX-XX          20707C7C    F425BF9A

ARR:           XX-XX(v0403t01)
SpO2:          MS DSP:4.6.0.2 MCU:1.0.0.4 PID:001 HW:000F
NIBP:          NB05
ECAPS:         ECAPS12C.DLL(XX-XX)
```

5. Select LOAD FROM BACKUP or LOAD FROM SD CARD in <LOAD SAVED SETTINGS>.

   When LOAD FROM BACKUP is selected, settings are loaded from the internal SD card.

   When LOAD FROM SD CARD is selected, settings are loaded from an optional SD card inserted into the slot.


SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS
BACK UP SETTINGS
BACK UP TO INTERNAL SD
BACK UP TO SD CARD
LOAD SAVED SETTINGS
LOAD FROM BACKUP
LOAD FROM SD CARD
OK

CAUTION

Do not turn off the power or remove the SD card while data is being loaded.

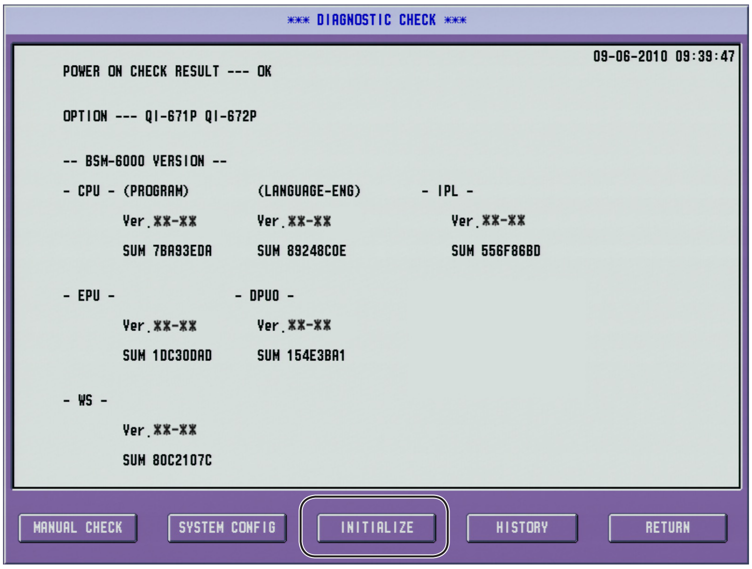
System Initialization

There are three modes of system initialization for the monitor.

- General
- Administrator
- Factory

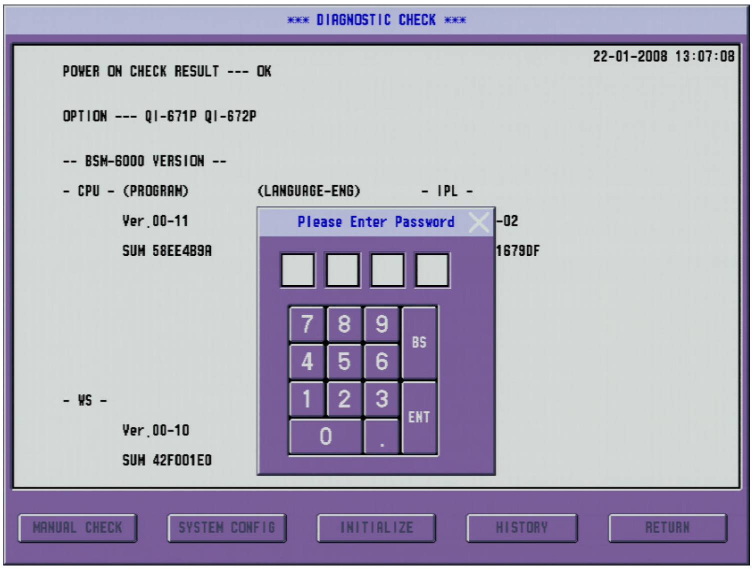
1. Start the monitor by pressing the [Power] switch while holding the [Silence Alarms] key.

2. When the DIAGNOSTIC CHECK screen appears, touch INITIALIZE.


*** DIAGNOSTIC CHECK ***
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

```
                                                         09-06-2010 09:39:47
    POWER ON CHECK RESULT --- OK

    OPTION --- QI-671P QI-672P

    -- BSM-6000 VERSION --
    - CPU - (PROGRAM)         (LANGUAGE-ENG)         - IPL -
            Ver.XX-XX         Ver.XX-XX                 Ver.XX-XX
            SUM 7BA93EDA      SUM 89248C0E              SUM 556F86BD

    - EPU -                 - DPU0 -
            Ver.XX-XX         Ver.XX-XX
            SUM 1DC30DAD      SUM 154E3BA1

    - WS -
            Ver.XX-XX
            SUM 80C2107C
```

3. When a window to enter a password as shown below appears, enter a four-digit password.


*** DIAGNOSTIC CHECK ***
Please Enter Password
7
8
9
BS
4
5
6
1
2
3
ENT
0
.
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

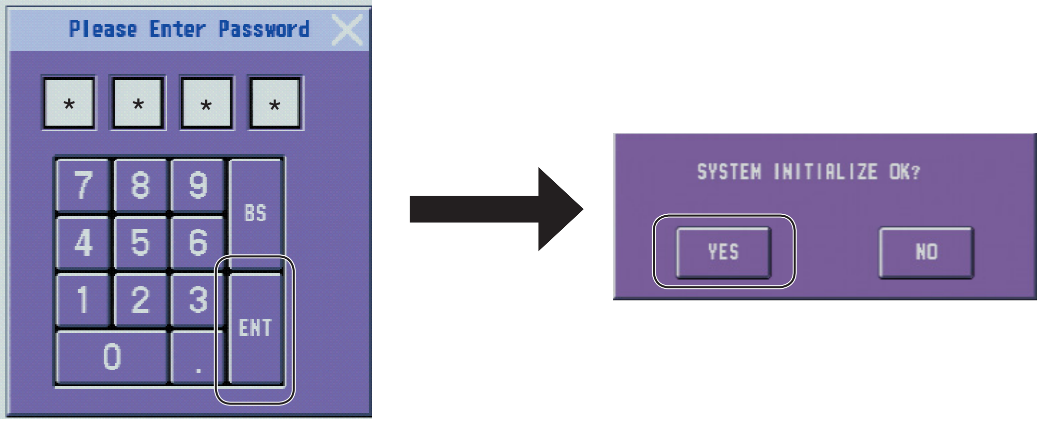
```
                                                         22-01-2008 13:07:08
    POWER ON CHECK RESULT --- OK

    OPTION --- QI-671P QI-672P

    -- BSM-6000 VERSION --
    - CPU - (PROGRAM)         (LANGUAGE-ENG)         - IPL -
            Ver.00-11                                -02
            SUM 58EE4B9A                             1679DF

    - WS -
            Ver.00-10
            SUM 42F001E0
```

The system initialization mode is determined by the password entered here.

- For the general mode
  Enter the password ("1234" by default).
- For the administrator or factory mode
  Enter the current time as the password (for example, if the current time is 10:46, enter "1046").

4. Touch ENT.

The “SYSTEM INITIALIZE OK?” message is displayed to confirm execution of the system initialization. Touch YES.



Please Enter Password

SYSTEM INITIALIZE OK?

To engage the factory mode, enter the current time as the password and touch YES while holding the [Silence Alarms] key.

Data Types to be Initialized

The data types to be initialized differ depending on the initialization mode. Check details in the table below.

System Initialization Modes	Settings	Review Data	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
General	Initialized	Initialized	Initialized	Retained	Initialized	Retained	Retained
Administrator	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Retained
Factory	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized

NOTE

When the factory mode is executed, the error history is initialized. When the error history is not to be initialized, execute administrator mode.

Upgrading the System Software and Changing the Language on the Screen

CAUTION

Upgrading the system software and changing the language on screen erases all system and monitoring settings. Write down these settings so they can be re-entered after the software upgrade.

The monitor uses a program card for upgrading its system software and changing the screen language. When the monitor detects that a program card is inserted into its SD card slot during the booting stage after it is turned on, it checks the program card for a system program or language. If the program card contains a newer version of the system program or language, the monitor automatically replaces its current system program or language information with the new one. If the program card contains a system program whose version number is the same or older than the one in the monitor, you have the option to replace or keep the current system program. If the program card does not contain a system program, the monitor continues the boot-up process.

In the system software upgrading or language changing process, the monitor first deletes the old system software or language stored in its system ROM. Then it checks whether the data in the system ROM is completely deleted. When the data is completely deleted, it copies the new version of the system program or language information from the program card to the system ROM and then checks the copy process. After the data is successfully copied, it performs the self-check programs to check the monitor.

Procedure

1. Write down the system setup settings and monitoring settings of the monitor.

2. Insert the program card into the SD card slot on the right side panel of the monitor.

3. Turn on the monitor. The monitor performs the upgrading process and self-check programs. The DIAGNOSTIC CHECK screen appears.

4. Confirm that the new system software version number appears.

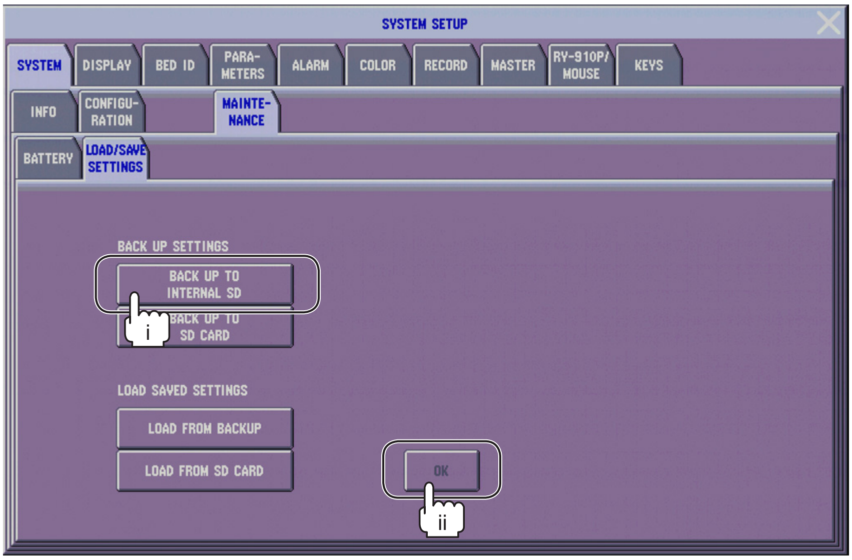
Backing Up Settings (System Setup)

The current system setup data can be backed up to the SD card built in the monitor main unit before execution of an upgrade.

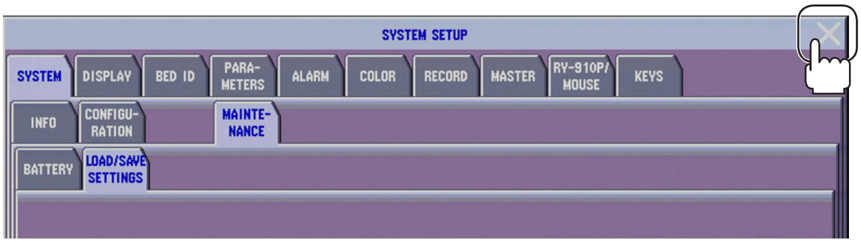
1. Display the SYSTEM SETUP window.
   For procedures of displaying the SYSTEM SETUP window, refer to the "Saving/Loading Settings" section.

2. Display the LOAD/SAVE SETTINGS.
   Touch the INFO → MAINTENANCE → LOAD/SAVE SETTINGS tab.

3. Back up the current settings.
   i) Touch BACK UP TO INTERNAL SD in <BACK UP SETTINGS>.
   ii) Touch OK to back up the settings.


SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS
BACK UP SETTINGS
BACK UP TO INTERNAL SD
BACK UP TO SD CARD
LOAD SAVED SETTINGS
LOAD FROM BACKUP
LOAD FROM SD CARD
OK
i
ii

4. Close the SYSTEM SETUP window by touching ☒.


SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS

Upgrade Procedures

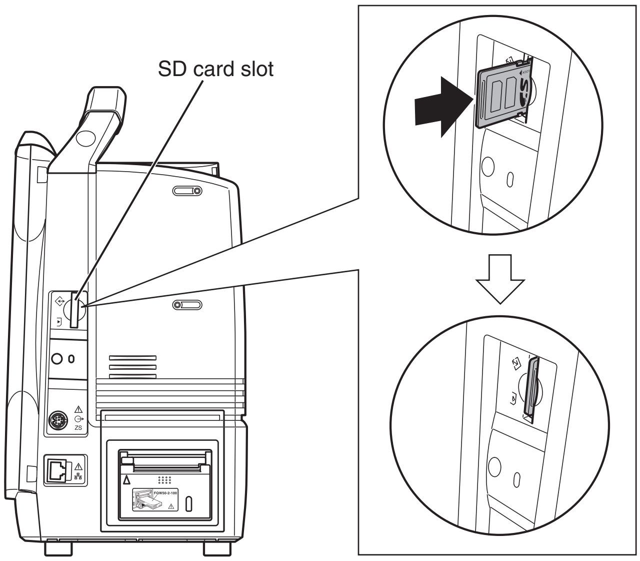
NOTE

- Upgrade cannot be performed on battery power. Perform the upgrade on AC power.
- Upgrading deletes the review data.

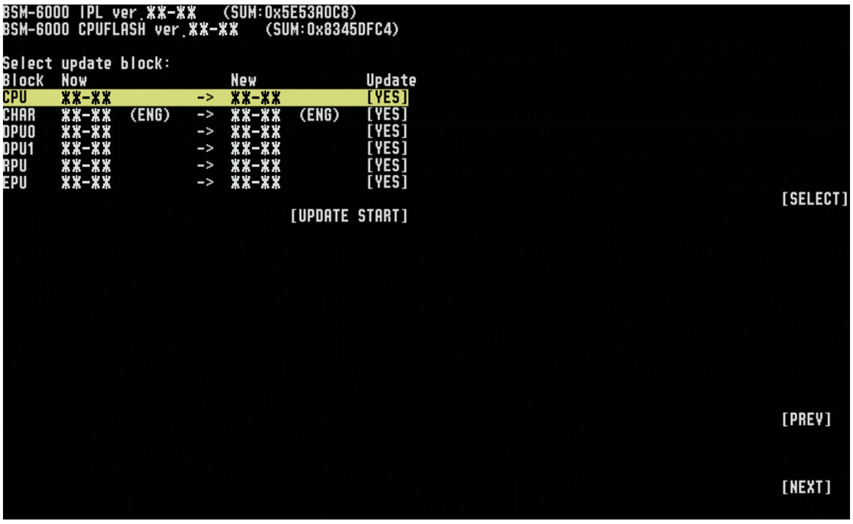
1. Turn off the power to the monitor if it is in the power-on status.

2. Connect an input unit to the monitor to simultaneously upgrade the input unit.

3. Insert the program card into the SD card slot on the right panel of the monitor as shown below.

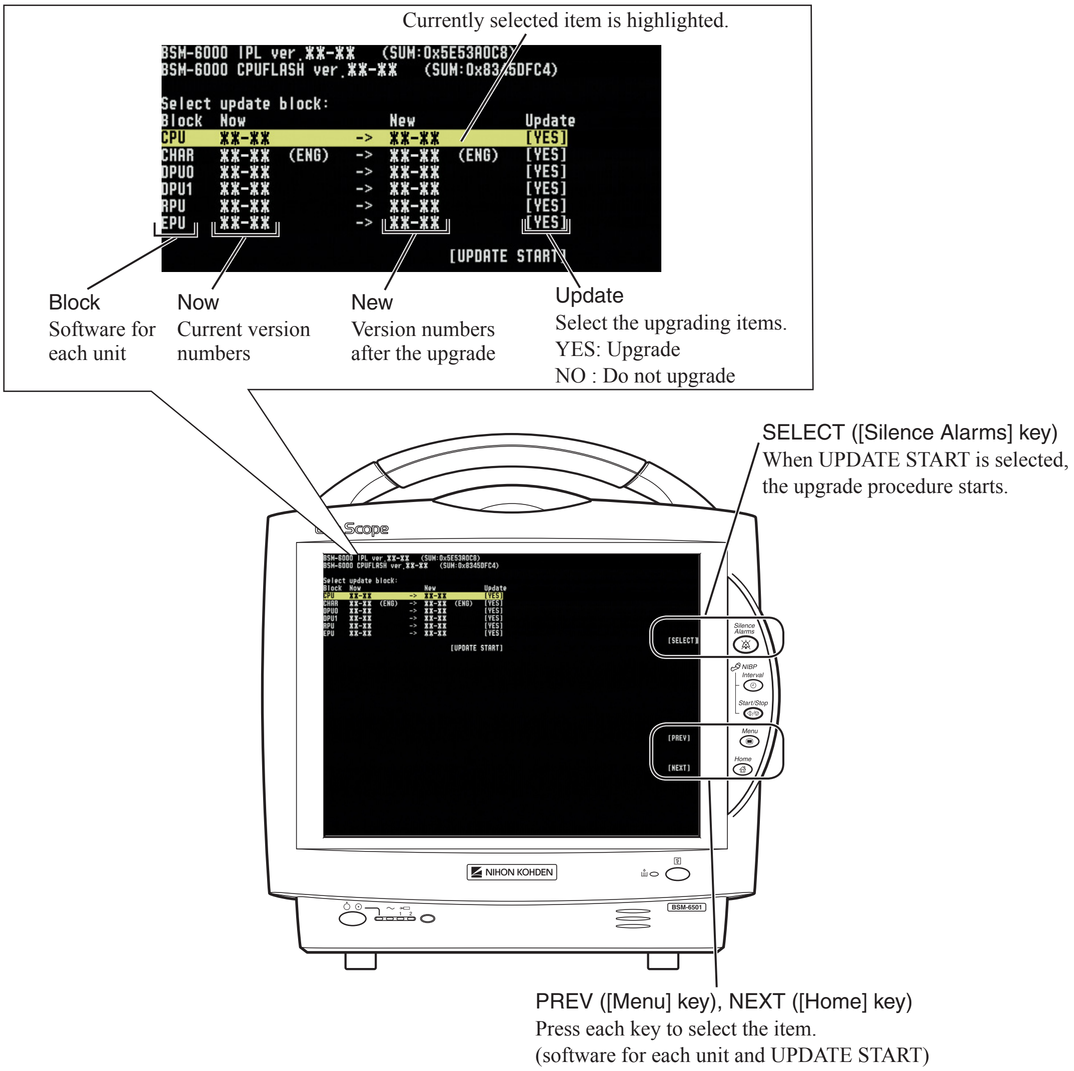


4. Turn on the power by pressing the [Power] switch on the front panel of the monitor. The screen for upgrade is displayed.



```
BSM-6000 IPL ver.XX-XX    (SUM:0x5E53A0C8)
BSM-6000 CPUFLASH ver.XX-XX    (SUM:0x8345DFC4)

Select update block:
Block  Now                  New             Update
CPU    XX-XX           ->   XX-XX           [YES]
CHAR   XX-XX  (ENG)    ->   XX-XX  (ENG)    [YES]
DPU0   XX-XX           ->   XX-XX           [YES]
DPU1   XX-XX           ->   XX-XX           [YES]
RPU    XX-XX           ->   XX-XX           [YES]
EPU    XX-XX           ->   XX-XX           [YES]
                                                                  [SELECT]
                                   [UPDATE START]

                                                                  [PREV]

                                                                  [NEXT]
```

5. Select whether the upgrade is to be performed or not for each unit software. Usually set YES for all. However, if the current version and the version after upgrade is the same, there is no need to set YES.
   i) Press PREV ([Menu] key) or NEXT ([Home] key) and select software.
   ii) Press SELECT ([Silence Alarms] key) to switch whether the upgrade is to be performed or not (YES/NO) for the currently selected software.



Currently selected item is highlighted.

```
BSM-6000 IPL ver.XX-XX    (SUM:0x5E53A0C8)
BSM-6000 CPUFLASH ver.XX-XX    (SUM:0x8345DFC4)

Select update block:
Block  Now                  New             Update
CPU    XX-XX           ->   XX-XX           [YES]
CHAR   XX-XX  (ENG)    ->   XX-XX  (ENG)    [YES]
DPU0   XX-XX           ->   XX-XX           [YES]
DPU1   XX-XX           ->   XX-XX           [YES]
RPU    XX-XX           ->   XX-XX           [YES]
EPU    XX-XX           ->   XX-XX           [YES]
                                   [UPDATE START]
```

Block
Software for each unit

Now
Current version numbers

New
Version numbers after the upgrade

Update
Select the upgrading items.
YES: Upgrade
NO : Do not upgrade

SELECT ([Silence Alarms] key)
When UPDATE START is selected, the upgrade procedure starts.

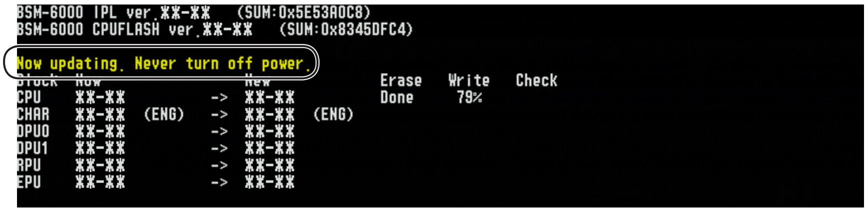
PREV ([Menu] key), NEXT ([Home] key)
Press each key to select the item.
(software for each unit and UPDATE START)

6. Execute upgrade.

NOTE

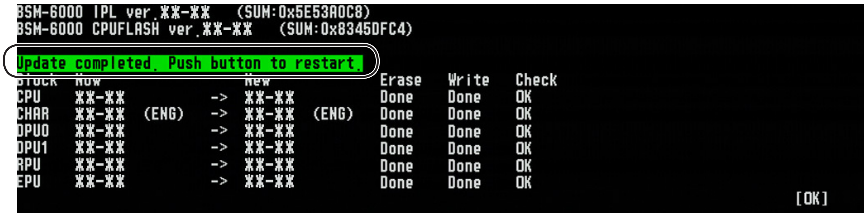
Do not turn off the power or remove the program card from the monitor main unit during the upgrade.

- i) Press PREV ([Menu] key) or NEXT ([Home] key) and select UPDATE START.
- ii) Press SELECT ([Silence Alarms] key) to start the upgrade procedure. While the upgrade is being processed, a “Now updating. Never turn off power.” message is displayed.



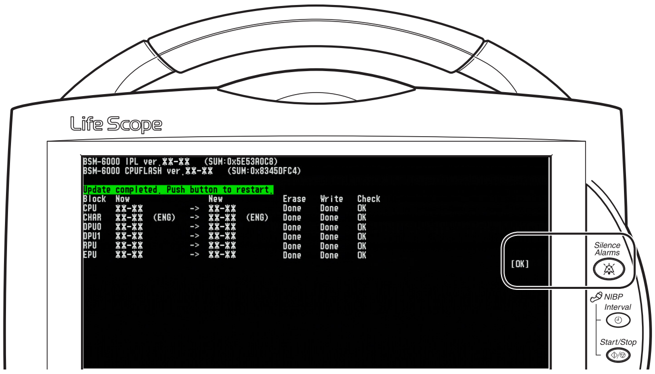
```
BSM-6000 IPL ver.XX-XX   (SUM:0x5E53A0C8)
BSM-6000 CPUFLASH ver.XX-XX   (SUM:0x8345DFC4)

Now updating. Never turn off power.
Block  Now              New              Erase   Write   Check
CPU    XX-XX         -> XX-XX            Done     79%
CHAR   XX-XX  (ENG)  -> XX-XX  (ENG)
DPU0   XX-XX         -> XX-XX
DPU1   XX-XX         -> XX-XX
RPU    XX-XX         -> XX-XX
EPU    XX-XX         -> XX-XX
```

- iii) During the upgrade an “Update completed. Push button to restart.” message is displayed.



```
BSM-6000 IPL ver.XX-XX   (SUM:0x5E53A0C8)
BSM-6000 CPUFLASH ver.XX-XX   (SUM:0x8345DFC4)

Update completed. Push button to restart.
Block  Now              New              Erase   Write   Check
CPU    XX-XX         -> XX-XX            Done    Done    OK
CHAR   XX-XX  (ENG)  -> XX-XX  (ENG)     Done    Done    OK
DPU0   XX-XX         -> XX-XX            Done    Done    OK
DPU1   XX-XX         -> XX-XX            Done    Done    OK
RPU    XX-XX         -> XX-XX            Done    Done    OK
EPU    XX-XX         -> XX-XX            Done    Done    OK
                                                                      [OK]
```

- iv) Press OK ([Silence Alarms] key). The monitor main unit restarts and the DIAGNOSTIC CHECK screen is displayed.

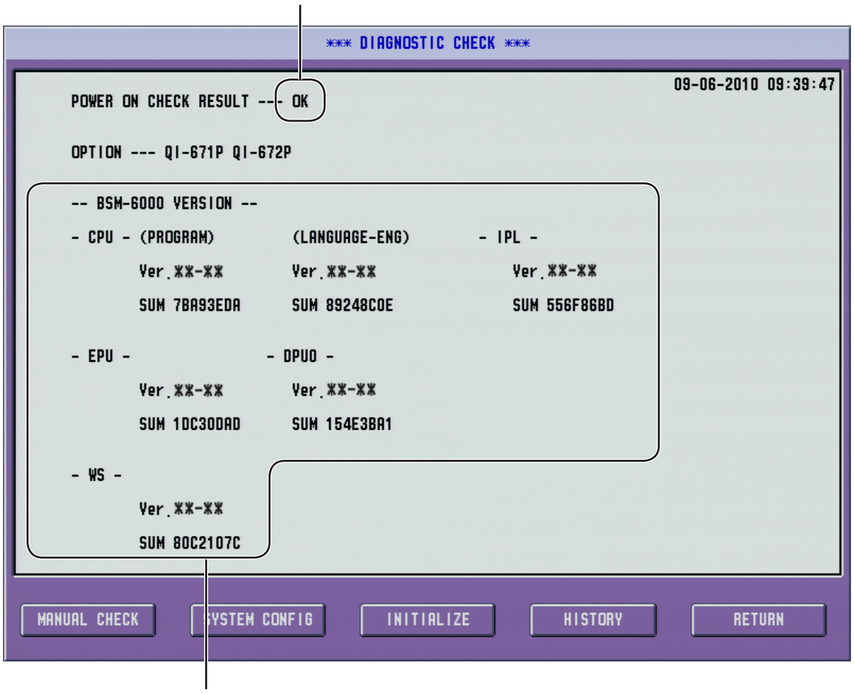


NOTE

If a “*** block update error” error message is displayed after the upgrade process is completed, display the DIAGNOSTIC CHECK screen and turn off the power of the monitor, and then do steps 4 through 6 again.

7. Check the versions.
   In the DIAGNOSTIC CHECK screen, check that <POWER ON CHECK RESULT> is OK and the software versions other than <- IPL -> have been changed to the new versions.

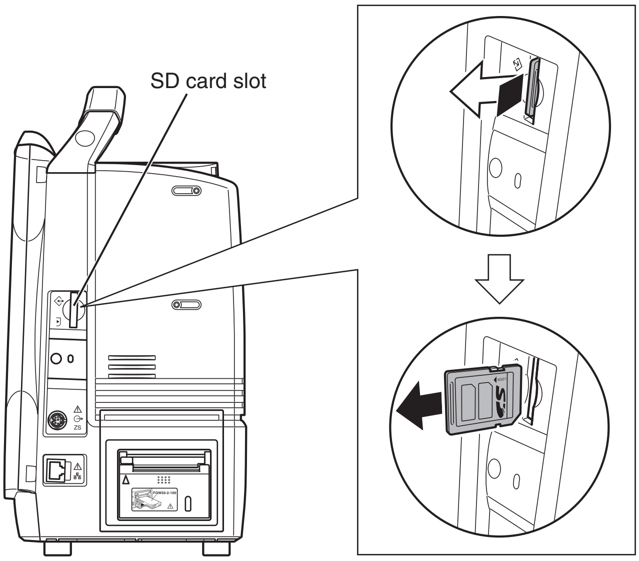
Check that OK is shown.



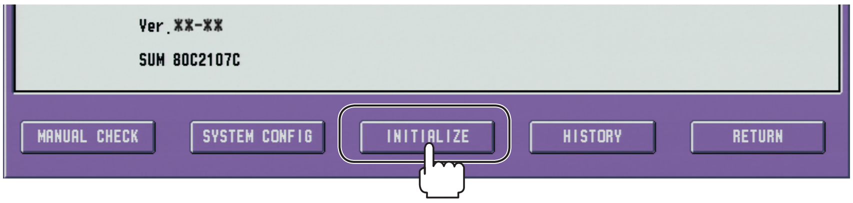
```
*** DIAGNOSTIC CHECK ***
                                                09-06-2010 09:39:47
POWER ON CHECK RESULT --- OK

OPTION --- QI-671P QI-672P

-- BSM-6000 VERSION --
- CPU - (PROGRAM)          (LANGUAGE-ENG)        - IPL -
        Ver.XX-XX          Ver.XX-XX               Ver.XX-XX
        SUM 7BA93EDA       SUM 89248C0E            SUM 556F86BD

- EPU -                 - DPU0 -
        Ver.XX-XX          Ver.XX-XX
        SUM 1DC30DAD       SUM 154E3BA1

- WS -
        Ver.XX-XX
        SUM 80C2107C
```

Check that the software versions other than <- IPL -> have been changed to the new versions.

8. Remove the program card from the monitor.
   Push the program card to remove it from the SD card slot of the monitor.



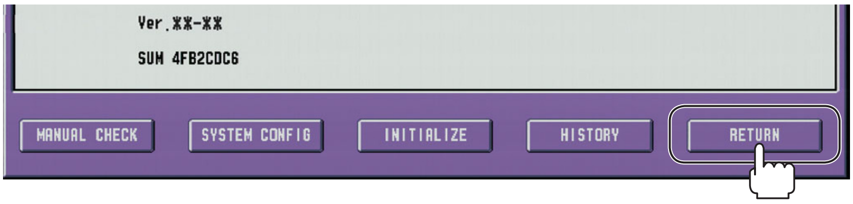
9. Initialize settings.
   i) Touch INITIALIZE in the DIAGNOSTIC CHECK screen to initialize the settings of the monitor. Execute the administrator mode by referring to “System Initialization”.



```
Ver.※※-※※
SUM 80C2107C
```

MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

   ii) When the initialization is completed, touch RETURN in the DIAGNOSTIC CHECK screen to display the home screen.



```
Ver.※※-※※
SUM 4FB2CDC6
```

MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

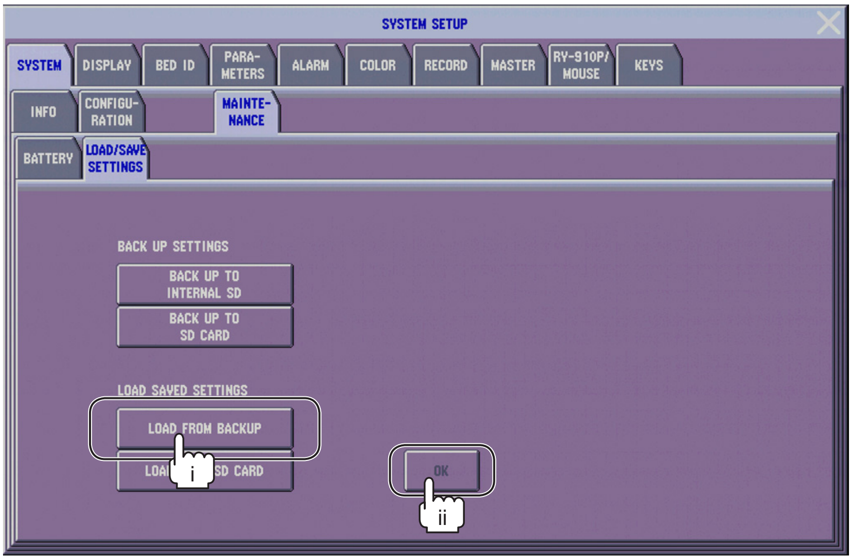
Loading Settings (System Setup)

When the upgrade process is completed, load the system setup data that has been backed up to the SD card built in the monitor.

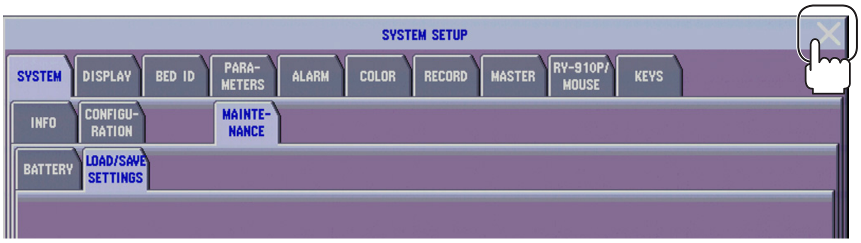
1. Display the SYSTEM SETUP window.
   For procedures of displaying the SYSTEM SETUP window, refer to “Saving/Loading Settings”.

2. Display the LOAD/SAVE SETTINGS.
   Touch the INFO → MAINTENANCE → LOAD/SAVE SETTINGS tab.

3. Load the backup settings.
   i) Touch LOAD FROM BACKUP in <LOAD SAVED SETTINGS>.
   ii) Touch OK to execute loading the settings.


SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS
BACK UP SETTINGS
BACK UP TO INTERNAL SD
BACK UP TO SD CARD
LOAD SAVED SETTINGS
LOAD FROM BACKUP
LOAD FROM SD CARD
OK
i
ii

4. Close the SYSTEM SETUP window by touching ☒.


SYSTEM SETUP
SYSTEM
DISPLAY
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
INFO
CONFIGU-RATION
MAINTE-NANCE
BATTERY
LOAD/SAVE SETTINGS

5. Turn off the power to the monitor and then turn it on to restart the monitor.

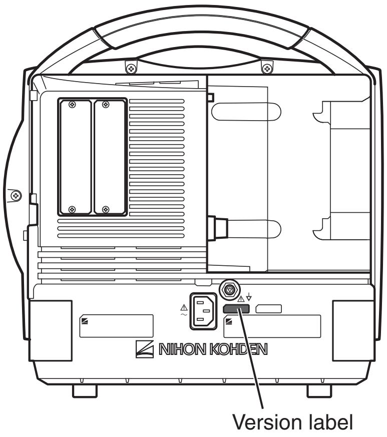
Replacing Version Labels

When the upgrade and load of the settings (system setup) are completed, peel off the old version label and attach the newly supplied version label (or attach the new version label over the old version label). After the label replacement is completed, send the following to your Nihon Kohden representative.

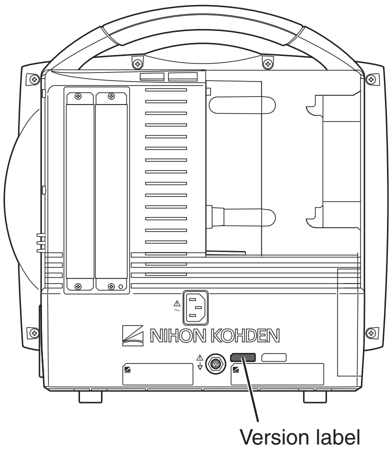
- Unused version label(s)
- List of the upgraded items

Monitor main unit

<MU-631R>

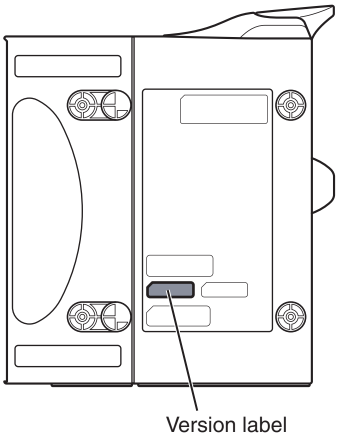

NIHON KOHDEN
Version label

<MU-651R/671R>

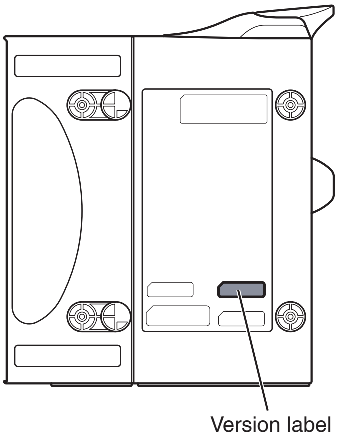

NIHON KOHDEN
Version label

Input unit

<AY-631P/633P/651P/653P>

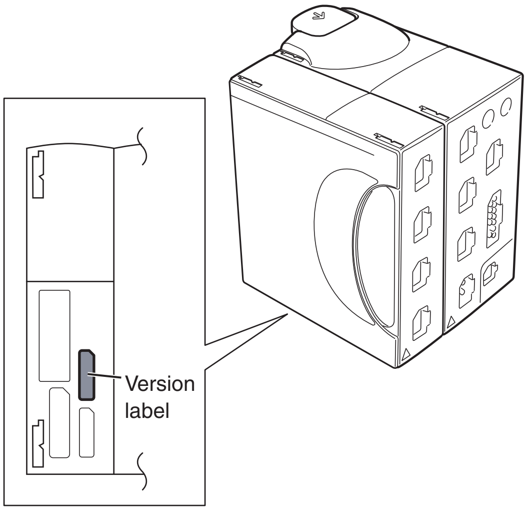

Version label

<AY-660P/661P/663P/671P/673P>


Version label

Smart Expansion Unit

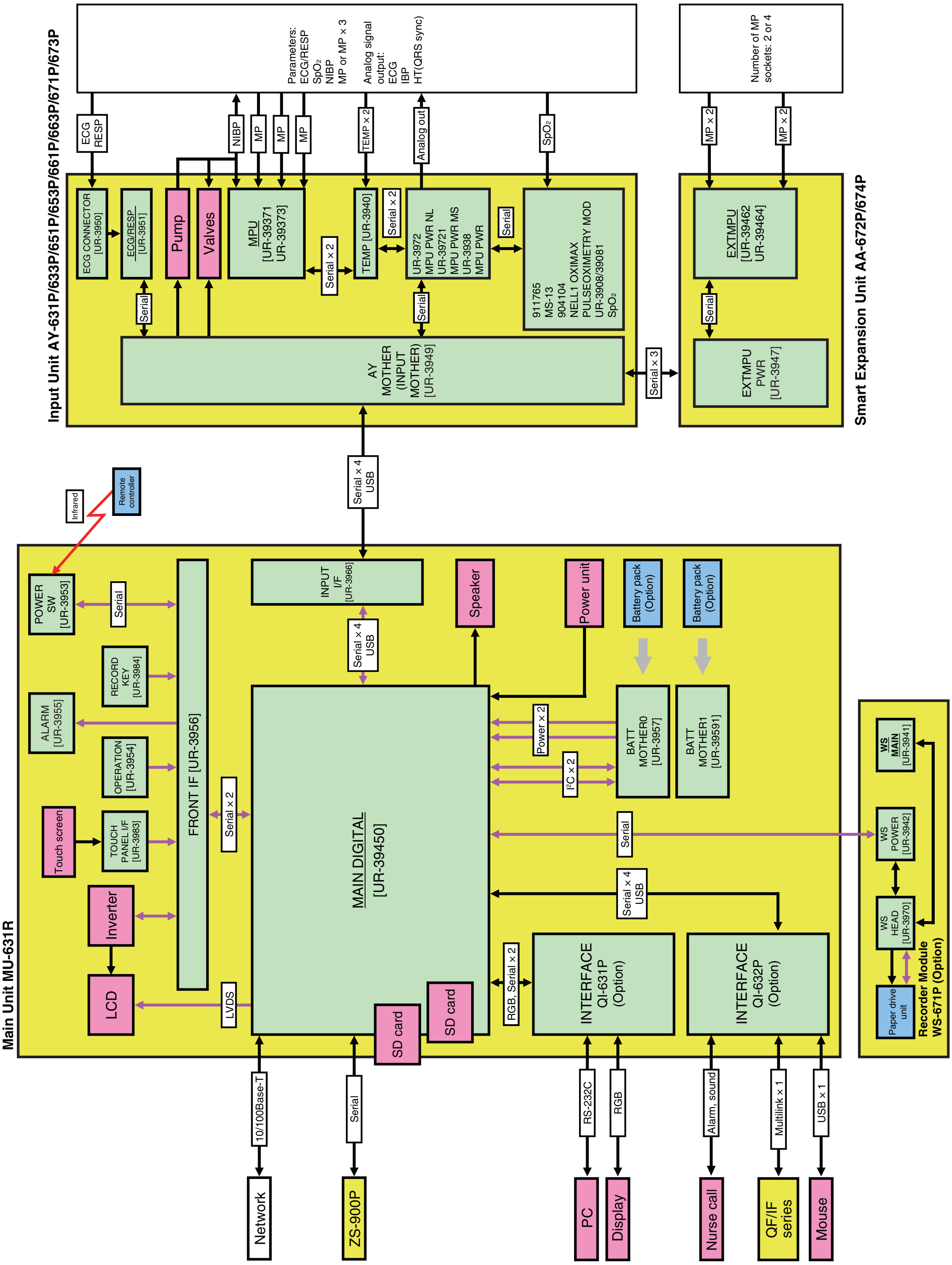
<AA-672P/674P>

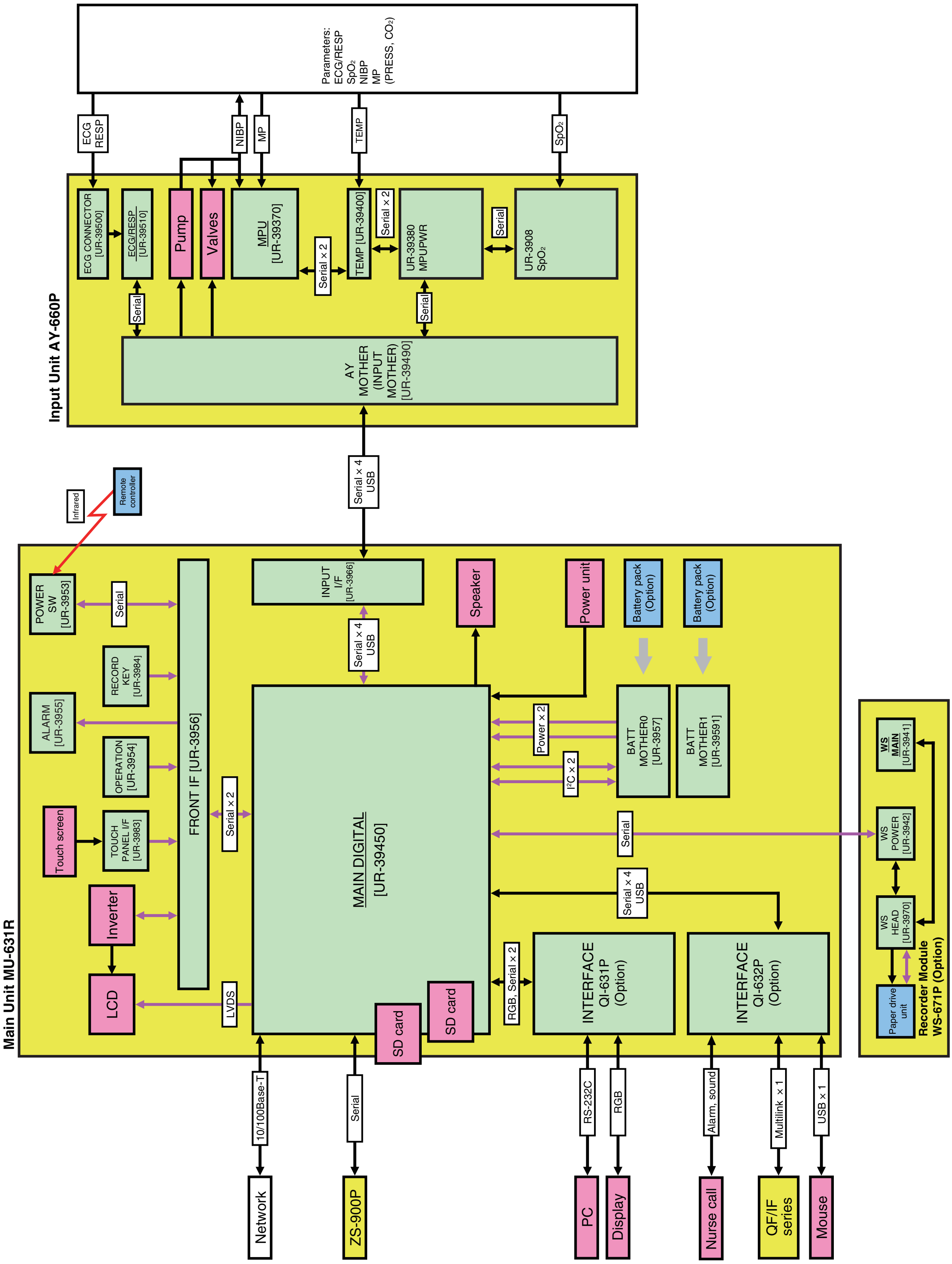


One software kit can be installed into total 80 units of main unit, input unit, smart expansion unit and recorder unit. However, only one copy of the accompanying document is supplied due to delivery reasons.

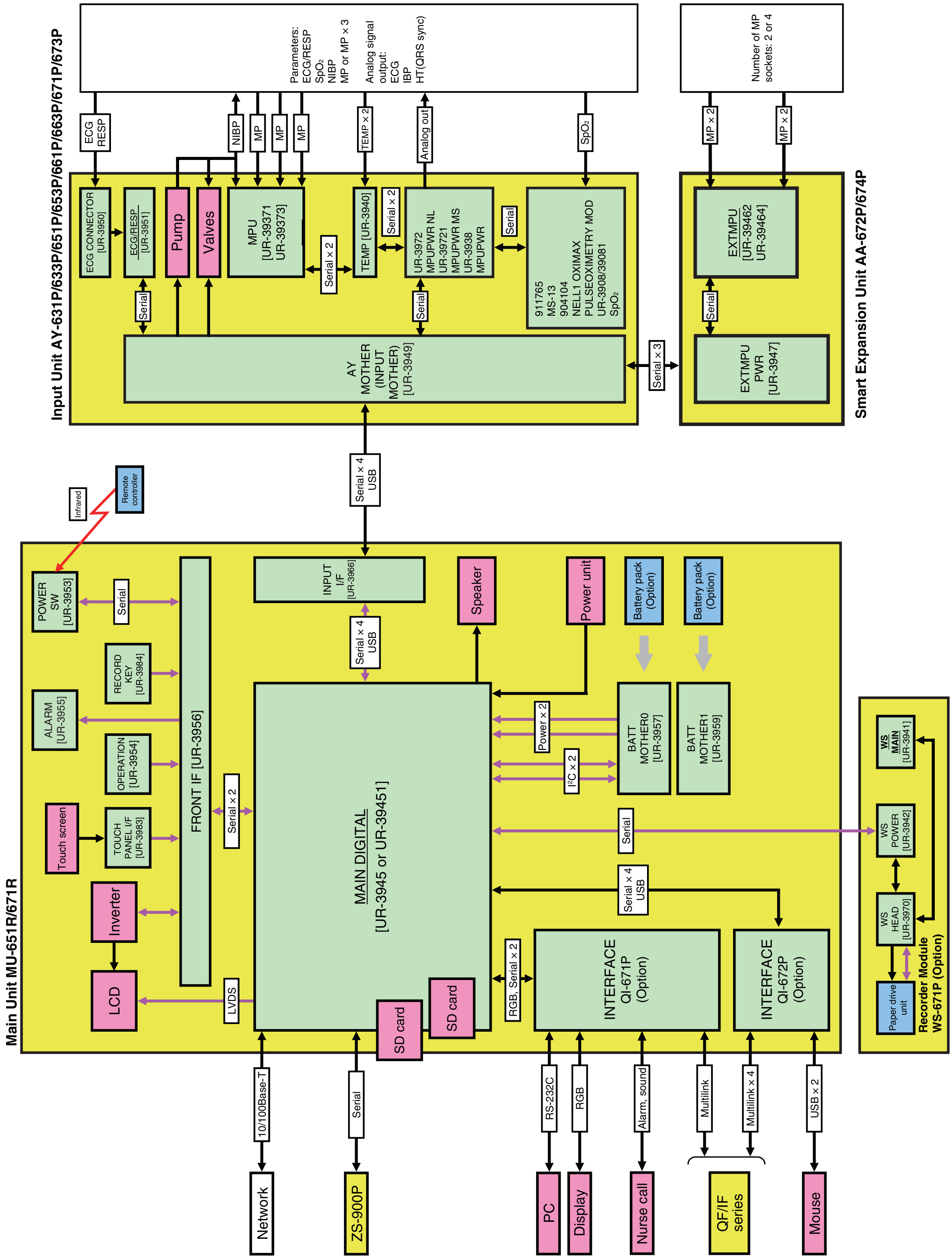
Board/Unit Connection Diagram

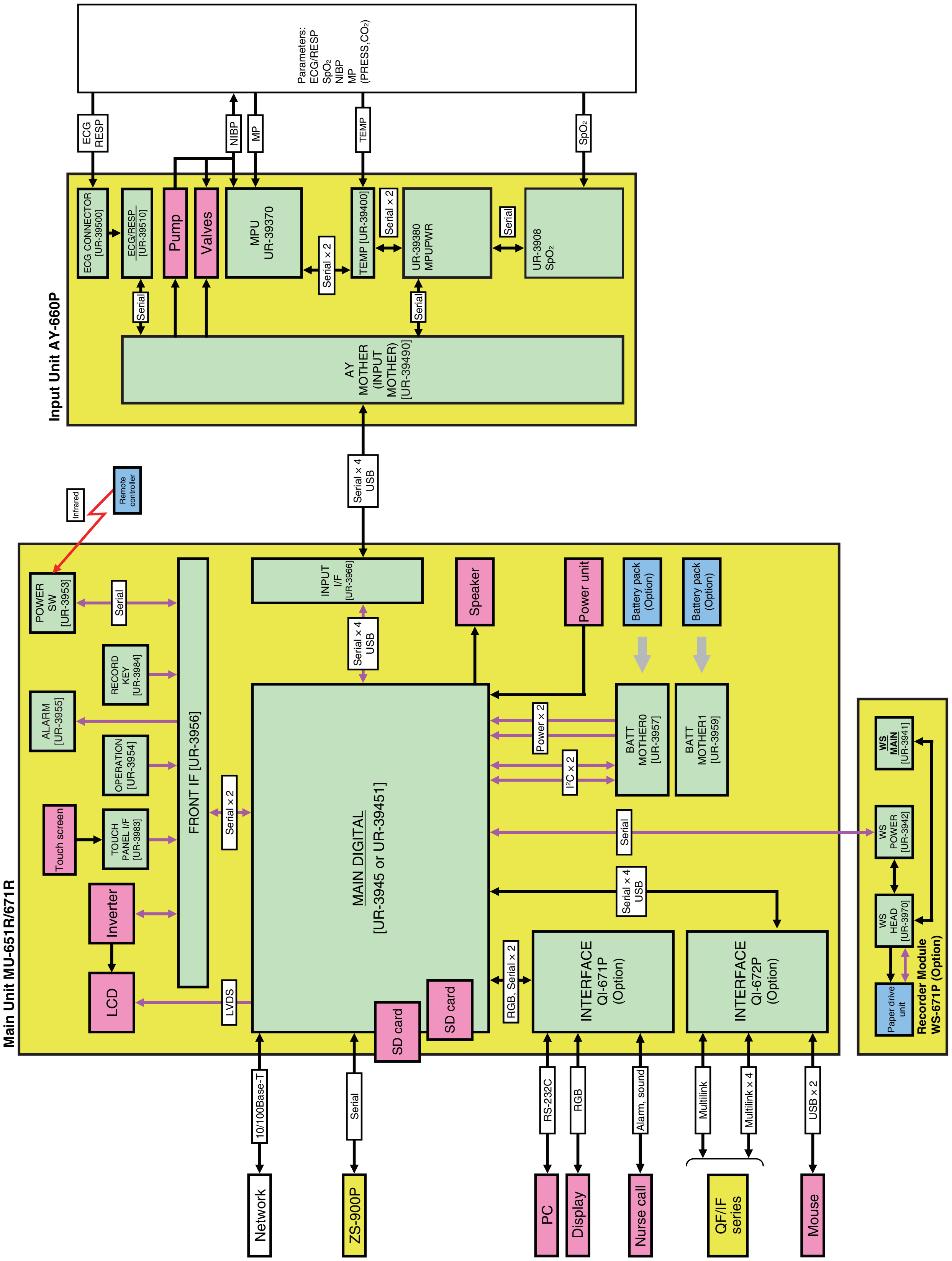
BSM-6301


Input Unit AY-631P/633P/651P/653P/661P/663P/671P/673P
Parameters:
ECG/RESP
SpO₂
NIBP
MP or MP × 3
Analog signal output:
ECG
IBP
HT(QRS sync)
ECG RESP
NIBP
MP
MP
MP
TEMP × 2
Analog out
SpO₂
ECG CONNECTOR [UR-3950]
ECG/RESP [UR-3951]
Pump
Valves
MPU [UR-39371 UR-39373]
Serial × 2
TEMP [UR-3940]
Serial × 2
UR-3972 MPU PWR NL
UR-39721 MPU PWR MS
UR-3938 MPU PWR
Serial
911765
MS-13
904104
NELL1 OXIMAX
PULSEOXIMETRY MOD
UR-3908/39081
SpO₂
Serial
Serial
AY MOTHER (INPUT MOTHER) [UR-3949]
Serial × 3
Number of MP sockets: 2 or 4
MP × 2
MP × 2
EXTMPU [UR-39462 UR-39464]
Serial
EXTMPU PWR [UR-3947]
Smart Expansion Unit AA-672P/674P
Serial × 4 USB
Infrared
Remote controller
Main Unit MU-631R
POWER SW [UR-3953]
Serial
RECORD KEY [UR-3984]
ALARM [UR-3955]
OPERATION [UR-3954]
Touch screen
TOUCH PANEL I/F [UR-3983]
Inverter
LCD
FRONT IF [UR-3956]
Serial × 2
LVDS
INPUT I/F [UR-3966]
Serial × 4 USB
MAIN DIGITAL [UR-39450]
SD card
SD card
Speaker
Power unit
Battery pack (Option)
Battery pack (Option)
Power × 2
I²C × 2
BATT MOTHER0 [UR-3957]
BATT MOTHER1 [UR-39591]
Serial
Serial × 4 USB
RGB, Serial × 2
INTERFACE QI-631P (Option)
INTERFACE QI-632P (Option)
WS MAIN [UR-3941]
WS POWER [UR-3942]
WS HEAD [UR-3970]
Paper drive unit
Recorder Module WS-671P (Option)
10/100Base-T
Serial
RS-232C
RGB
Alarm, sound
Multilink × 1
USB × 1
Network
ZS-900P
PC
Display
Nurse call
QF/IF series
Mouse


Parameters:
ECG/RESP
SpO₂
NIBP
MP
(PRESS, CO₂)
ECG RESP
NIBP
MP
TEMP
SpO₂
Input Unit AY-660P
ECG CONNECTOR [UR-39500]
ECG/RESP [UR-39510]
Pump
Valves
MPU [UR-39370]
Serial × 2
TEMP [UR-39400]
Serial × 2
UR-39380 MPUPWR
Serial
UR-3908 SpO₂
Serial
Serial
AY MOTHER (INPUT MOTHER) [UR-39490]
Serial × 4 USB
Infrared
Remote controller
Main Unit MU-631R
POWER SW [UR-3953]
Serial
RECORD KEY [UR-3984]
ALARM [UR-3955]
OPERATION [UR-3954]
Touch screen
TOUCH PANEL I/F [UR-3983]
Inverter
LCD
FRONT IF [UR-3956]
Serial × 2
LVDS
INPUT I/F [UR-3966]
Serial × 4 USB
MAIN DIGITAL [UR-39450]
SD card
SD card
Speaker
Power unit
Battery pack (Option)
Battery pack (Option)
BATT MOTHER0 [UR-3957]
BATT MOTHER1 [UR-39591]
Power × 2
I²C × 2
Serial
Serial × 4 USB
RGB, Serial × 2
INTERFACE QI-631P (Option)
INTERFACE QI-632P (Option)
WS MAIN [UR-3941]
WS POWER [UR-3942]
WS HEAD [UR-3970]
Paper drive unit
Recorder Module WS-671P (Option)
10/100Base-T
Serial
RS-232C
RGB
Alarm, sound
Multilink × 1
USB × 1
Network
ZS-900P
PC
Display
Nurse call
QF/IF series
Mouse

BSM-6501/BSM-6701


Input Unit AY-631P/633P/651P/653P/661P/663P/671P/673P
Parameters:
ECG/RESP
SpO₂
NIBP
MP or MP × 3
Analog signal output:
ECG
IBP
HT(QRS sync)
ECG RESP
NIBP
MP
MP
MP
TEMP × 2
Analog out
SpO₂
ECG CONNECTOR [UR-3950]
ECG/RESP [UR-3951]
Pump
Valves
MPU [UR-39371 UR-39373]
Serial × 2
TEMP [UR-3940]
Serial × 2
UR-3972 MPUPWR NL
UR-39721 MPUPWR MS
UR-3938 MPUPWR
Serial
911765 MS-13
904104 NELL1 OXIMAX
PULSEOXIMETRY MOD
UR-3908/39081
SpO₂
Serial
Serial
AY MOTHER (INPUT MOTHER) [UR-3949]
Serial × 3
Number of MP sockets: 2 or 4
MP × 2
MP × 2
EXTMPU [UR-39462 UR-39464]
Serial
EXTMPU PWR [UR-3947]
Smart Expansion Unit AA-672P/674P
Serial × 4 USB
Infrared
Remote controller
Main Unit MU-651R/671R
POWER SW [UR-3953]
Serial
RECORD KEY [UR-3984]
ALARM [UR-3955]
OPERATION [UR-3954]
Touch screen
TOUCH PANEL I/F [UR-3983]
Inverter
LCD
FRONT IF [UR-3956]
Serial × 2
LVDS
INPUT I/F [UR-3966]
Serial × 4 USB
MAIN DIGITAL [UR-3945 or UR-39451]
SD card
SD card
Speaker
Power unit
Battery pack (Option)
Battery pack (Option)
Power × 2
I²C × 2
BATT MOTHER0 [UR-3957]
BATT MOTHER1 [UR-3959]
Serial
Serial × 4 USB
RGB, Serial × 2
INTERFACE QI-671P (Option)
INTERFACE QI-672P (Option)
WS MAIN [UR-3941]
WS POWER [UR-3942]
WS HEAD [UR-3970]
Paper drive unit
Recorder Module WS-671P (Option)
10/100Base-T
Serial
RS-232C
RGB
Alarm, sound
Multilink
Multilink × 4
USB × 2
Network
ZS-900P
PC
Display
Nurse call
QF/IF series
Mouse


Parameters:
ECG/RESP
SpO₂
NIBP
MP
(PRESS,CO₂)
ECG RESP
NIBP
MP
TEMP
SpO₂
Input Unit AY-660P
ECG CONNECTOR [UR-39500]
ECG/RESP [UR-39510]
Pump
Valves
MPU UR-39370
Serial × 2
TEMP [UR-39400]
Serial × 2
UR-39380 MPUPWR
Serial
UR-3908 SpO₂
Serial
Serial
AY MOTHER (INPUT MOTHER) [UR-39490]
Serial × 4 USB
Infrared
Remote controller
Main Unit MU-651R/671R
POWER SW [UR-3953]
Serial
RECORD KEY [UR-3984]
ALARM [UR-3955]
OPERATION [UR-3954]
Touch screen
TOUCH PANEL I/F [UR-3983]
Inverter
LCD
FRONT IF [UR-3956]
Serial × 2
LVDS
INPUT I/F [UR-3966]
Serial × 4 USB
MAIN DIGITAL [UR-3945 or UR-39451]
SD card
SD card
Speaker
Power unit
Battery pack (Option)
Battery pack (Option)
BATT MOTHER0 [UR-3957]
BATT MOTHER1 [UR-3959]
Power × 2
I²C × 2
Serial
Serial × 4 USB
RGB, Serial × 2
INTERFACE QI-671P (Option)
INTERFACE QI-672P (Option)
Recorder Module WS-671P (Option)
WS MAIN [UR-3941]
WS POWER [UR-3942]
WS HEAD [UR-3970]
Paper drive unit
10/100Base-T
Serial
RS-232C
RGB
Alarm, sound
Multilink
Multilink × 4
USB × 2
Network
ZS-900P
PC
Display
Nurse call
QF/IF series
Mouse

Replaceable Parts/Boards/Units

Refer to Section 7 “Replaceable Parts List”.

MU-631R

Types/Part Numbers	Part Names	Remarks
UR-39450	MAIN DIGITAL board	—
UR-3962	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3983: Touch panel I/F board UR-3984: Record key board
UR-3956	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-39591	BATT MOTHER1 board	—
914218	Touch screen	—
921504	10.4-inch TFT LCD display	—
929541	Backlight	—
913959	Inverter	—
SC-631R	Power unit with heat sink chassis block	—
916858	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
926767	SD card 256 MB	—
919552	SD card 128 MB	—

MU-651R

Types/Part Numbers	Part Names	Remarks
UR-3945	MAIN DIGITAL board	—
UR-3962	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3983: Touch panel I/F board UR-3984: Record key board
UR-3956	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-3959	BATT MOTHER1 board	—
916885	Touch screen	—
916359	12.1-inch TFT LCD display	—
709699	Backlight	—
913959	Inverter	—
SC-671R	Power unit with heat sink chassis block	—
916867	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
926767	SD card 256 MB	—
919552	SD card 128 MB	—

MU-671R

Types/Part Numbers	Part Names	Remarks
UR-3945	MAIN DIGITAL board	—
UR-3962	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3983: Touch panel I/F board UR-3984: Record key board
UR-3956	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-3959	BATT MOTHER1 board	—
914209*	Touch screen	—
913941	15-inch TFT LCD display	—
921157	Backlight	—
913968	Inverter	—
SC-671R	Power unit with heat sink chassis block	—
916867	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
926767	SD card 256 MB	—
919552	SD card 128 MB	—

WS-671P

Types/Part Numbers	Part Names	Remarks
UR-3941	WS-MAIN board	—
UR-3942	WS-power board	—
UR-3970	WS-head board	—
RG-501X	Paper drive unit	—
YS-086P9	Magazine door assy	—
662311	Thermal head	—
6114-908494	Head pressure plate	—

QI-671P

Types/Part Numbers	Part Names	Remarks
QI-671P	Interface	Board inside QI-671P is not available.

QI-672P

Types/Part Numbers	Part Names	Remarks
QI-672P	Interface	Board inside QI-672P is not available.

QI-631P

Types/Part Numbers	Part Names	Remarks
QI-631P	Interface	Board inside QI-631P is not available.

QI-632P

Types/Part Numbers	Part Names	Remarks
QI-632P	Interface	Board inside QI-632P is not available.

QI-634P

Types/Part Numbers	Part Names	Remarks
QI-634P	Interface	Board inside QI-634P is not available.

AY-631P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-39721	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
611394	Solenoid valve	Included in SG-671P
622364	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
911765	SpO_2 unit by MASIMO Corporation	—

AY-633P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-39721	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
611394	Solenoid valve	Included in SG-673P
622364	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
911765	SpO_2 unit by MASIMO Corporation	—

AY-651P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3972	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
611394	Solenoid valve	Included in SG-671P
622364	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
719697	SpO_2 unit by NELLCOR	—

AY-653P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3972	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
611394	Solenoid valve	Included in SG-673P
622364	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
719697	SpO_2 unit by NELLCOR	—

AY-660P

Types/Part Numbers	Part Names	Remarks
UR-39490	AY MOTHER (INPUT MOTHER) board	—
UR-39500	ECG connector board	—
UR-39510	ECG RESP board	—
UR-39380	MPUPWR board	—
UR-39400	TEMP board	—
SG-670P	NIBP unit	—
UR-39370	MPU board	Included in SG-670P
611394	Solenoid valve	Included in SG-670P
622364	Solenoid valve	Included in SG-670P
532149	NIBP pump	Included in SG-670P
UR-3908	SpO_2 board	—

AY-661P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
611394	Solenoid valve	Included in SG-671P
622364	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
UR-3908	SpO_2 board	—

AY-663P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
611394	Solenoid valve	Included in SG-673P
622364	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
UR-3908	SpO_2 board	—

AY-671P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
611394	Solenoid valve	Included in SG-671P
622364	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
UR-39081	SpO_2 board	—

AY-673P

Types/Part Numbers	Part Names	Remarks
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
611394	Solenoid valve	Included in SG-673P
622364	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
UR-39081	SpO_2 board	—

AA-672P

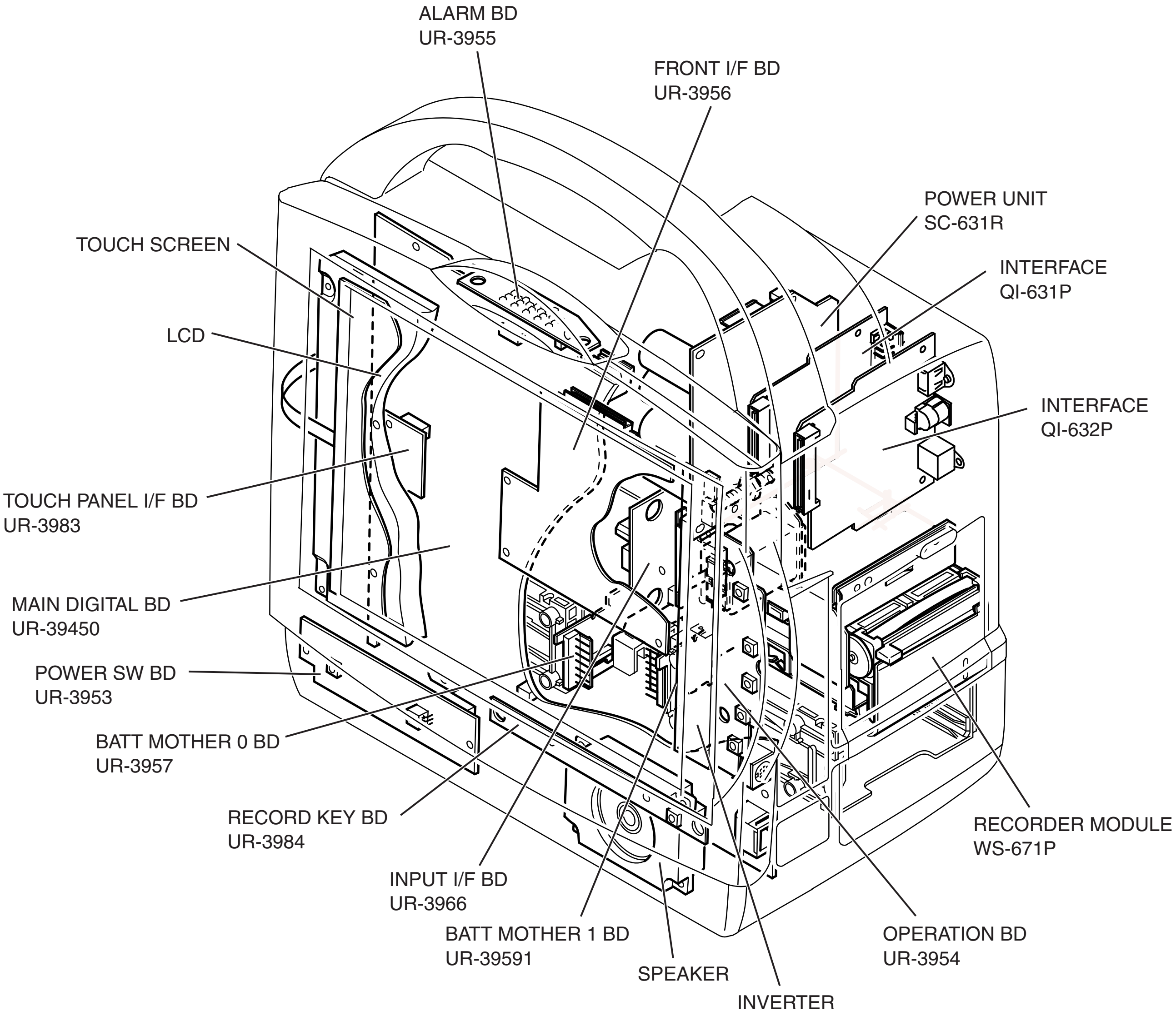
Types/Part Numbers	Part Names	Remarks
UR-39462	EXTMPU board	—
UR-3947	EXTMPU PWR board	—

AA-674P

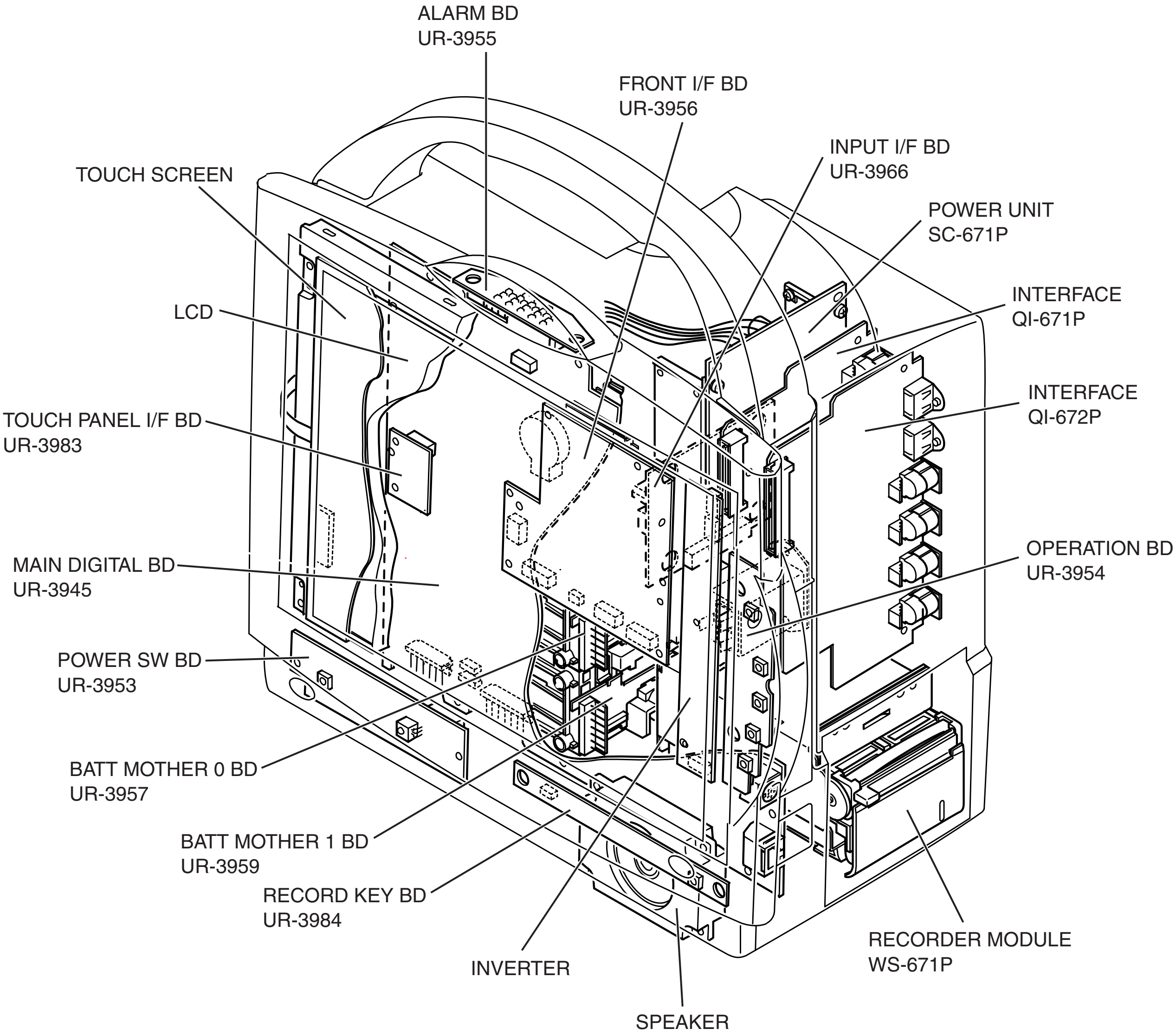
Types/Part Numbers	Part Names	Remarks
UR-39464	EXTMPU board	—
UR-3947	EXTMPU PWR board	—

Board/Unit Layout

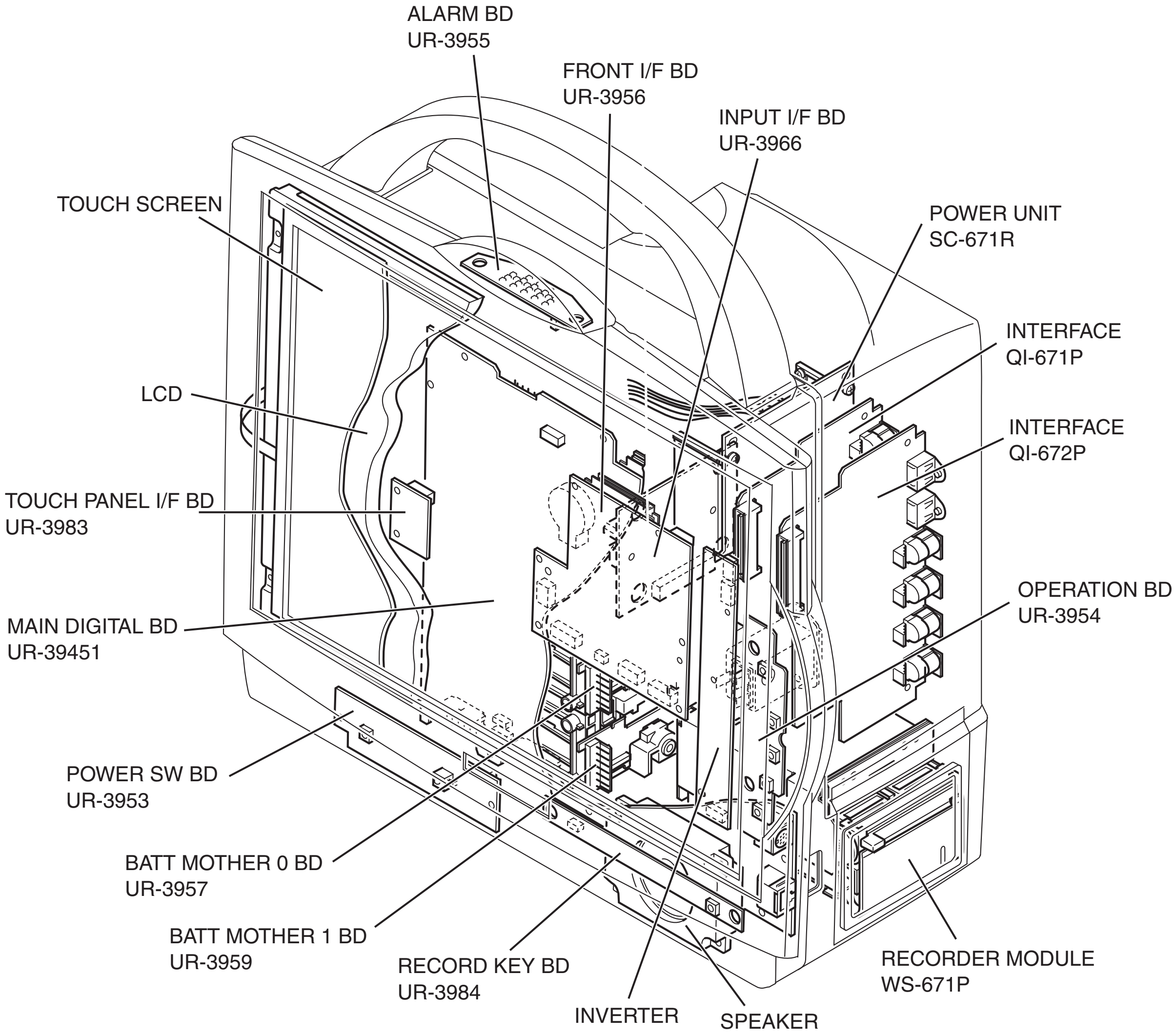
MU-631R


ALARM BD
UR-3955
FRONT I/F BD
UR-3956
POWER UNIT
SC-631R
INTERFACE
QI-631P
TOUCH SCREEN
LCD
INTERFACE
QI-632P
TOUCH PANEL I/F BD
UR-3983
MAIN DIGITAL BD
UR-39450
POWER SW BD
UR-3953
BATT MOTHER 0 BD
UR-3957
RECORD KEY BD
UR-3984
RECORDER MODULE
WS-671P
INPUT I/F BD
UR-3966
BATT MOTHER 1 BD
UR-39591
OPERATION BD
UR-3954
SPEAKER
INVERTER

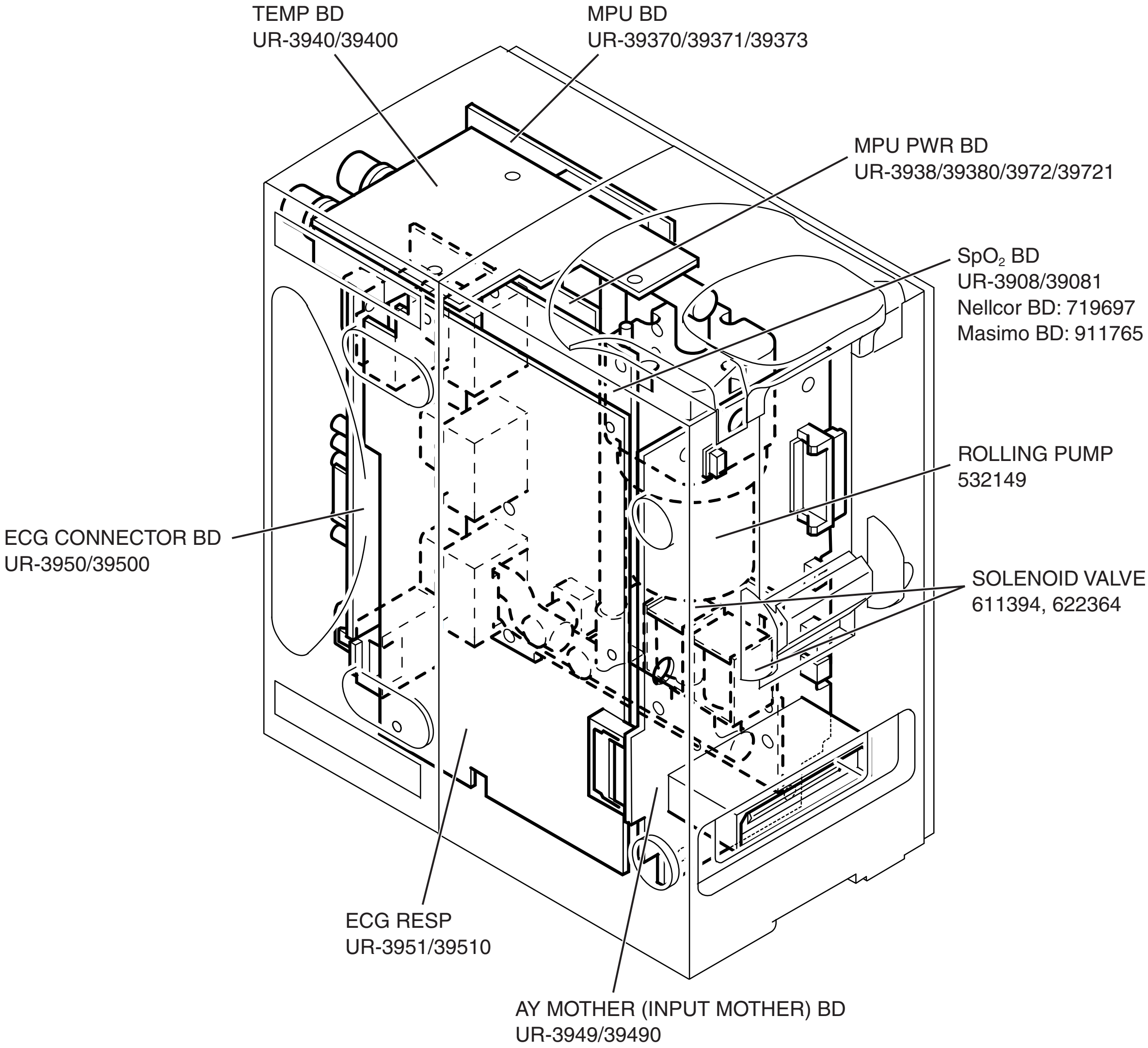
MU-651R


ALARM BD
UR-3955
FRONT I/F BD
UR-3956
INPUT I/F BD
UR-3966
TOUCH SCREEN
POWER UNIT
SC-671P
INTERFACE
QI-671P
LCD
INTERFACE
QI-672P
TOUCH PANEL I/F BD
UR-3983
OPERATION BD
UR-3954
MAIN DIGITAL BD
UR-3945
POWER SW BD
UR-3953
BATT MOTHER 0 BD
UR-3957
BATT MOTHER 1 BD
UR-3959
RECORD KEY BD
UR-3984
RECORDER MODULE
WS-671P
INVERTER
SPEAKER

MU-671R


ALARM BD
UR-3955
FRONT I/F BD
UR-3956
INPUT I/F BD
UR-3966
TOUCH SCREEN
POWER UNIT
SC-671R
INTERFACE
QI-671P
LCD
INTERFACE
QI-672P
TOUCH PANEL I/F BD
UR-3983
OPERATION BD
UR-3954
MAIN DIGITAL BD
UR-39451
POWER SW BD
UR-3953
BATT MOTHER 0 BD
UR-3957
BATT MOTHER 1 BD
UR-3959
RECORD KEY BD
UR-3984
RECORDER MODULE
WS-671P
INVERTER
SPEAKER

AY-631P/633P/651P/653P/660P/661P/663P/671P/673P


TEMP BD
UR-3940/39400
MPU BD
UR-39370/39371/39373
MPU PWR BD
UR-3938/39380/3972/39721
SpO$_2$ BD
UR-3908/39081
Nellcor BD: 719697
Masimo BD: 911765
ROLLING PUMP
532149
ECG CONNECTOR BD
UR-3950/39500
SOLENOID VALVE
611394, 622364
ECG RESP
UR-3951/39510
AY MOTHER (INPUT MOTHER) BD
UR-3949/39490

Section 2 Troubleshooting

General ... 2.2
Screen Messages ... 2.3
Troubleshooting ... 2.20
  Power-related Problems ... 2.20
  Display Problems ... 2.21
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  Sound Problems ... 2.22
  Key Operation Problems ... 2.22
  Recording Problems ... 2.23
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  SD Card Problem ... 2.24
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  Problems in ECG Measurement ... 2.27
  Problems In Respiration (Impedance Method) Measurement ... 2.28
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  Problem in Temperature (TEMP) Measurement ... 2.31
  Problems in Respiration (Thermister Method) Measurement ... 2.32
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  Problem in Cardiac Output (CO) Measurement ... 2.34
  Problems in Non-invasive Blood Pressure (NIBP) Measurement ... 2.35
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Error Code and History ... 2.37
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General

Use the screen messages and troubleshooting tables to locate, identify, and solve a problem in the monitor.

You can also view the error code and history on the HISTORY screen of the DIAGNOSTIC CHECK screen. The error code list is listed at the end of this section.

NOTE

When contacting your Nihon Kohden representative for technical support, please provide detailed information on the problem. This will allow your Nihon Kohden representative to provide you with the best support.

How to Troubleshoot

1. Refer to the screen messages table.
2. Determine which troubleshooting table to use.
3. In the “Trouble” column, find the trouble item that matches the problem.
4. Do the action recommended in the “Action” column.
5. If the problem is not solved, do the action for the next possible cause or criteria.
6. If you cannot solve the problem using this troubleshooting information, contact your Nihon Kohden representative.

Screen Messages

The messages are listed in alphabetical order. Each message is followed by the corresponding cause and countermeasure.

An item with an asterisk (*) in the left column is an alarm.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	– – – ALARM	All parameters	Alarm concerning the – – – (parameter name) occurred.	Take appropriate action depending on the alarm level. (Displaying the home screen may display the alarm in detail.)
–	Bed name INTERBED ALARM	All parameters	Alarm occurred on an interbed bed of the bed name.	Check the data of the alarmed bed on the INTERBED window and remove the cause.
–	ALARM SILENCED	All parameters	The [Silence Alarms] key was pressed to silence the alarm.	• When the alarm cause is resolved, the alarm is cleared. • When the [Silence Alarms] key is pressed during alarm silence, all alarms are resumed.
–	ALARMS SUSPENDED	All parameters	The [Silence Alarms] key was pressed before alarm occurrence.	To cancel alarm suspension, press the [Silence Alarms] key again.
–	ALARMS SUSPENDED – min	All parameters	The SUSPEND MONITORING key was touched.	All alarms resume when the SUSPEND MONITORING or SUSPEND ALARMS key is touched again during alarm suspension.
			The SUSPEND ALARMS key was touched.	
–	ALL ALARMS OFF	All parameters	The BYPASS key or ALL ALARMS OFF key is touched to suspend alarm function.	To resume alarm function, touch the BYPASS or ALL ALARMS OFF key.
–	ARRHYTHMIA ANALYSIS OFF	ECG	<ARRHYTHMIA ANALYSIS> on the SYSTEM SETUP window is set to OFF.	If arrhythmia analysis is necessary, set <ARRHYTHMIA ANALYSIS> on the SYSTEM SETUP window to ON.
*	BATTERY ERROR	System	Battery problems.	Contact your Nihon Kohden representative.
*	BATTERY WEAK	System	Remaining battery is less than 25%.	Switch to AC power and charge the battery pack.
*	BIS CHECK EXTERNAL DEVICE	BIS (BIS monitor)	The BIS monitor is disconnected from the bedside monitor.	Check the interface connection between the BIS monitor and bedside monitor.
*	BIS CHECK SENSOR	BIS (BIS processor/ BISx)	The BIS sensor is detached from the patient.	Attach the BIS sensor to the patient properly.
			The BIS sensor is disconnected from the PIC Plus patient interface cable.	Connect the BIS sensor to the PIC Plus patient interface cable properly.
			The PIC Plus patient interface cable is disconnected from the BIS processor.	Connect the PIC Plus patient interface cable to the BIS processor properly.
			The impedance between the BIS sensor and skin is too high.	Check the BIS sensor attachment and remove the cause. If necessary, replace it with a new one. Use only the specified BIS sensor.
*	BIS CONNECTOR OFF	BIS (BIS processor/ BISx)	The BIS processor is disconnected from the connection cord or the connection cord is disconnected from the monitor.	Check that the BIS processor is firmly connected to the connection cord and connection cord is firmly connected to the monitor.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	BIS HIGH IMPEDANCE	BIS (BIS processor/ BISx)	The impedance between the BIS sensor and skin is too high.	Check the BIS sensor attachment and if necessary, replace it with a new one.
–	BIS CHECKING IMPEDANCE	BIS (BIS processor/ BISx)	The impedance of the BIS sensor is being checked.	Wait until the impedance check is complete.
*	BIS MODULE FAILURE	BIS (BIS processor/ BISx)	Faulty BIS processor.	Contact your Nihon Kohden representative.
–	BIS NOISE	BIS (BIS processor/ BISx)	Noise interference.	Check the BIS sensor attachment. If necessary, replace the sensor with a new one.
*	BIS SENSOR ERROR	BIS (BIS processor/ BISx)	The BIS sensor failure.	Display the BIS window and touch the RESET key after replacing the BIS sensor with a new one.
*	BIS SENSOR EXPIRED	BIS (BIS processor/ BISx)	BIS sensor is past its expiration date.	Replace the BIS sensor with a new one.
*	CCO ALARM	CCO CCO/$S\bar{v}O_2$	Alarm occurring on the CCO monitor.	Check the CCO monitor and remove the cause of the alarm.
*	CCO CHECK EXTERNAL DEVICE	CCO CCO/$S\bar{v}O_2$	The CCO monitor is disconnected from the bedside monitor.	Check the interface connection between the CCO monitor and the bedside monitor.
*	CLOCK IC FAILURE	System	The clock circuit is damaged.	Contact your Nihon Kohden representative.
–	CLOSE PAPER MAGAZINE	Recording	The recorder door is open.	Push the recorder door closed until it clicks.
–	CO BASELINE DRIFT	CO	Physiological change.	Increase the injectate volume or cool the injectate.
			Using a respirator.	Adjust the respiration phases.
			Injection interval is short.	Increase the injection interval.
			Noise interference from external devices.	Place external devices as far as possible from the catheter.
*	CO CHECK SENSOR	CO	The catheter is not connected to the CO connection cord.	Connect the catheter to the CO connection cord properly.
			The catheter is faulty.	Replace the catheter with a new one.
			The CO connection cord is damaged.	Replace the CO connection cord with a new one.
*	CO CONNECTOR OFF	CO	The CO connection cord is disconnected from the monitor.	Connect the connection cord properly. When CO monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The CO connection cord is damaged.	Replace the CO connection cord with a new one.
–	CO DETECTING BASELINE	CO	Searching for the baseline of the blood temperature.	Wait for the baseline of the blood temperature to be detected.
–	CO INJECT	CO	Injectate is not injected or the monitor does not acknowledge that injectate is injected.	Inject the injectate. The monitor has not acknowledged the injection if the “MEASURING CO” message is not displayed on the CO window even when the injectate is injected. Inject the injectate again.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	CO INJECTION TIME OUT	CO	Injectate is not detected within 4 minutes after the “INJECT” message was displayed (or 30 seconds after the MANUAL key is pressed).	Touch the MANUAL key and inject the injectate within 30 seconds.
–	CO MEASURING CO	CO	Measuring the CO.	Wait for the calculation to be completed.
–	CO OUT OF RANGE	CO	Calculated a value outside the measuring range.	If the catheter retaining condition is not appropriate, the temperature change becomes small and the CO value may be outside the measuring range. Check the catheter retaining condition and the coefficient value setting.
			The coefficient value of the injectate temperature is not specified by the catheter manufacturer.	Make sure the injectate temperature is within the range specified by the manufacturer. For example, when using a Becton Dickinson catheter, the coefficient values for the injectate temperature between 5 and 18°C are not specified so do not use an injectate temperature between 5 and 18°C.
–	CO Tb TEMP ERROR	CO	The blood temperature is below 15°C or above 45°C.	—
			The catheter is faulty.	Replace the catheter with a new one.
–	CO THERMODILUTION CURVE ERROR	CO	Returned to the baseline of the thermodilution curve too late.	Use the appropriate injection method.
			Possible endocardial shunt.	Check the accuracy of the measured value.
–	CO Ti TEMP ERROR	CO	The injectate is not cooled or the room temperature is above 27°C.	Cool the injectate or decrease the room temperature.
			The bath probe or inline sensor is faulty.	Replace the probe or sensor with a new one.
*	CO_2 APNEA	CO_2	Apnea exceeded the apnea alarm limit.	—
–	CO_2 CAL?? (when using TG-950P/970P CO_2 sensor kit)	CO_2	Zero calibration is not performed.	Perform zero calibration.
–	CO_2 CAL COMPLETE	CO_2	Calibration is complete.	—
–	CO_2 CAL ERROR	CO_2	Calibration failed.	Calibrate again. If the problem still occurs, contact your Nihon Kohden representative.
*	CO_2 CHANGE ABSORBENT	CO_2 Sidestream	The CO_2 absorbent needs to be replaced.	Contact your Nihon Kohden representative.
*	CO_2 CHANGE ADAPTER	CO_2	The CO_2 adapter is damaged.	Replace the CO_2 adapter with a new one.
*	CO_2 CHECK SENSOR	CO_2 Mainstream	Insufficient sensor light.	Refer to the CO_2 sensor kit manual. If necessary, replace the kit with a new one.
*	CO_2 CHECK EXTERNAL DEVICE	CO_2 Microcap®	The QF-921P interface is disconnected from the bedside monitor or Microcap® monitor.	Check all cable connections between the Microcap® monitor and bedside monitor.
		CO_2 Sidestream	The AG-400R CO_2 unit is disconnected from the bedside monitor.	Check the interface connection between the AG-400R CO_2 unit and bedside monitor.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	CO_2 DEVICE ERROR	CO_2 Microcap®	The Microcap® monitor or QF-921P interface failure.	Contact your Nihon Kohden representative.
			Communication error between the Microcap® monitor and bedside monitor.	
*	CO_2 CONNECTOR OFF	CO_2 Mainstream	The CO_2 sensor kit is disconnected from the monitor.	Connect the CO_2 sensor kit properly. When CO_2 monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The CO_2 sensor kit is damaged.	Replace the CO_2 sensor kit with a new one.
*	CO_2 DEVICE ERROR	CO_2 Sidestream	CO_2 unit failure.	Contact your Nihon Kohden representative.
*	CO_2 LINE BLOCK	CO_2 Sidestream/ Microcap®	The airway adapter, filterline or exhaust gas tube is clogged and CO_2 cannot be measured.	Check that there is no clog in the airway adapter, filterline or exhaust gas tube. If necessary, replace with a new one.
				Make sure that the filterline is placed above the airway adapter.
*	CO_2 NO FILTERLINE	CO_2 Sidestream	The filterline is not connected to the CO_2 unit or unspecified tube is connected.	Firmly connect the specified filterline to the CO_2 unit.
		CO_2 Microcap®	The filterline is not connected to the Microcap® monitor or unspecified tube is connected.	Firmly connect the specified filterline to the Microcap® monitor.
–	CO_2 PLEASE WAIT	CO_2 Sidestream	Measurement of the sensitivity calibration is completed and calculation is started.	Stop the gas supply and wait for the calculation to complete.
–	CO_2 PURGING	CO_2 Sidestream/ Microcap®	Purging to remove clog from the sampling path.	When the clog is removed, measurement is possible. If the clog is not removed, the “CO_2 LINE BLOCK” message appears. Refer to the “CO_2 LINE BLOCK” message.
*	CO_2 SENSOR ERROR	CO_2 Mainstream	CO_2 sensor is damaged.	Replace the CO_2 sensor with a new one.
–	CO_2 WARMING UP	CO_2 Sidestream	The CO_2 unit is warming up. Measurement is not possible.	Wait for the message to disappear.
		CO_2 Microcap®	The Microcap® monitor is warming up. Measurement is not possible.	
–	CO_2 ZERO CALIBRATING	CO_2 Microcap®	Auto zero balance adjustment is being performed.	Wait until zero balance adjustment is complete.
–	CO_2 ZEROING	CO_2 Sidestream/ Mainstream with TG-950P/970P	Zeroing.	Wait for the zeroing to complete.
–	CO_2 ZEROING COMPLETED	CO_2 (TG-950P/970P only)	Zeroing is complete.	—
–	CO_2 ZEROING ERROR	CO_2 (TG-950P/970P only)	Zeroing failed.	Perform zeroing again. If the problem still occurs, contact your Nihon Kohden representative.
–	CONNECT INPUT UNIT	System	The input unit is not connected to the main unit or data acquisition unit and the monitor is not ready for monitoring when the transport function is enabled.	Connect the input unit to the main unit or data acquisition unit and authenticate the patient on the SELECT PATIENT DATA window.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	DATA SEND ERROR	System	The network cable is not properly connected to the bedside monitor, hub and central monitor.	Connect the network cable to the bedside monitor, hub and central monitor properly and insert and remove the input unit from the bedside monitor.
			The network cable is damaged.	Replace the network cable with a new one and insert and remove the input unit from the bedside monitor.
			The bedside monitor is not registered as a monitored bed on the central monitor.	Register the bedside monitor on the central monitor as a monitored bed and insert and remove the input unit from the bedside monitor.
–	ECG AUTO LEAD CHANGE	ECG	<AUTO LEAD CHANGE> on the ECG window is set to ON, an electrode of the lead for the first trace was detached for more than 5 seconds and therefore the lead was changed to a stable lead.	Check the electrode attachment.
–	ECG CANNOT ANALYZE	ECG	Noise interference for more than 30 seconds and heart rate cannot be counted and arrhythmia cannot be analyzed.	Remove noise.
*	ECG CHECK ELECTRODES	ECG	The electrode lead is detached from the electrode.	Connect the electrode lead to the electrode firmly.
		ECG	The electrode cannot be attached firmly to the skin.	Replace the electrode with a new one.
		ECG	The electrode lead is disconnected from the ECG connection cord.	Connect the electrode lead to the ECG connection cord.
		ECG	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
		ECG	<NUMBER OF ELECTRODES> setting on the ECG window is not correct.	Set the correct settings for <NUMBER OF ELECTRODES>.
		ECG	The electrode lead is damaged.	Replace the electrode lead with a new one.
		ECG	Differential offset voltage at electrodes.	Replace the electrode with a new one.
*	ECG CHECK ELECTRODE – –	ECG	Problems at the specified electrode.	Remove the cause by referring to the "ECG CHECK ELECTRODES" message.
–	ECG LEARNING	ECG	Started learning QRS for arrhythmia analysis.	Wait for learning to finish.
*	ECG MODULE ERROR	ECG	Module malfunction.	Contact your Nihon Kohden representative.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	ECG NOISE	ECG	The baseline is not stable due to respiration or body movement.	Change the electrode position.
		ECG	EMG noise is superimposed.	Change the electrode position to where there is less muscle.
		ECG	The electrode is pulled by the lead.	Put some slack into the electrode lead.
		ECG	The electrode is dry.	Replace the electrode with a new one.
		ECG	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
		ECG	High electrode impedance.	Rub the skin with “skinPure” skin preparation gel.
		ECG	An electric blanket is used.	Use another warming method.
		ECG	Equipment which emits strong electromagnetic interference is nearby. e.g. ESU, cellular phone.	Keep the interference source away from the monitor or turn off the emitter source power.
		ECG	Equipotential grounding is not acquired.	Connect the equipotential ground terminal on the monitor to the equipotential ground terminal on the wall with the grounding lead.
–	ECG PACING (This message appears only when pacing spike detection on the ECG window is set to ON.)	ECG	Paced QRS is detected.	When the patient does not have an implanted cardiac pacemaker, set the pacing spike detection to OFF on the ECG window.
			An electric blanket is used.	Use another warming method.
			ECG of a neonate is monitored.	Set the pacing spike detection to OFF on the ECG window.
–	EEG CALIBRATING	EEG	The CAL key on the EEG window is touched to display the calibration waveforms.	—
*	EEG CHECK ELECTRODES	EEG	The electrode is dry or not attached to the patient.	Attach the electrodes to the patient properly. When using disposable electrodes, replace them with new one.
			The electrode lead is disconnected from the EEG connection cord.	Connect the electrode lead to the EEG connection cord.
			Contact between the electrode lead clip and electrode is poor (when using disposable electrodes).	Replace the EEG electrode lead with a new one.
			The electrode lead is damaged.	Replace the electrode lead with a new one.
			Differential offset voltage at electrodes.	Attach the electrodes to the patient properly. When using disposable electrodes, replace them with new one.
			The electrode impedance is too high.	Clean the attachment site and attach the electrodes again.
			The EEG connection cord is disconnected then connected.	When the EEG connection cord is disconnected and then connected again, this message may appear. Press the [Silence Alarms] key to clear the message.
*	EEG CHECK EXTERNAL DEVICE	EEG	The neuro unit is disconnected from the bedside monitor.	Check the cable connection between the units.
–	EEG CHECKING IMPEDANCE	EEG	Checking electrode impedance.	—

	Screen Message	Parameter	Possible Cause/Criteria	Action
*	EEG CONNECTOR OFF	EEG	The EEG connection cord is disconnected from the neuro unit.	Connect the EEG connection cord to the neuro unit. When EEG monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The EEG connection cord is damaged.	Replace the EEG connection cord with a new one.
–	EEG HIGH IMPEDANCE	EEG	The electrode impedance is too high.	Clean the attachment site and attach the electrodes again.
–	EEG RESETTING BASELINE	EEG	The RESET key on the EEG window is touched to return all EEG waveforms to the baseline position.	—
*	FLOW APNEA	FLOW/Paw	Apnea exceeded the apnea alarm limit.	—
–	FLOW CAL COMPLETE	FLOW/Paw	Zero calibration is complete.	—
–	FLOW CAL ERROR	FLOW/Paw	There was vibration during calibration and zeroing failed.	If the message appears several times, contact your Nihon Kohden representative.
			Nearby device was generating a strong noise during calibration and zeroing failed.	
*	FLOW CONNECTOR OFF	FLOW/Paw	Faulty flow tube.	Replace the flow tube with a new one.
			The flow tube is disconnected from the unit.	Connect the flow tube to the unit securely.
*	FLOW CHECK EXTERNAL DEVICE	FLOW/Paw	Measure switch on the unit is turned off.	Turn on the measure switch on the unit.
			The connection cable is disconnected from the monitor.	Check the connection between the unit and the monitor.
			An error occurs in the communication between the unit and monitor.	Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative.
		FLOW/Paw GF-220PA	The power cord is disconnected.	Check the power cord is securely connected.
		FLOW/Paw	<FLOW/Paw MEASUREMENT> on the FLOW/Paw window is OFF.	Set the <FLOW/Paw MEASUREMENT> on the FLOW/Paw window to ON.
*	FLOW EXTERNAL DEVICE ERROR	FLOW/Paw	Faulty unit.	Contact your Nihon Kohden representative.
–	FLOW OUT OF RANGE	FLOW/Paw	The measured value is outside the measurable range.	Replace the flow tube and/or flow adapter with a new one. If the problem still occurs, contact your Nihon Kohden representative.
–	FLOW ZERO CALIBRATING	FLOW/Paw	Zero calibration is being performed.	Wait for calibration to complete.
–	FREEZE	All parameters	The waveforms are frozen.	To unfreeze the waveforms: • Press any key on the screen • Press any key on the monitor • The waveforms are unfreezed 3 minutes after freezing
*	GAS APNEA	GAS	Apnea exceeded the apnea alarm limit.	—
–	GAS CALIBRATING	GAS	Air or gas calibration is being performed.	Wait for the calibration to complete.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	GAS CAL COMPLETE	GAS GF-110PA/120PA GF-210R/220R	Air or gas calibration is complete.	—
–	GAS CAL ERROR	GAS	The sampling line or exhaust gas tube is clogged.	Check that the sampling line and exhaust gas tube are not bent or clogged. Replace with a new one if necessary and perform the manual or air calibration. If the problem still occurs, contact your Nihon Kohden representative.
			Contaminated air due to leaking prevented air calibration.	Check that sampling line and respiration circuit are not leaking. After confirming that there are no leaking, ventilate the air around the unit and perform the manual air calibration. If the problem still occurs, contact your Nihon Kohden representative.
		GAS AG-920R GF-110PA/120PA	The pressure in the gas cylinder is less than 0.1 MPa.	If the pressure in the gas cylinder is less than 0.1 MPa, replace with a new calibration gas and calibrate again.
			Correct gas is not used for calibration.	Check that correct gas is used for calibration.
*	GAS CHANGE WATERTRAP	GAS	The water trap is clogged.	Empty the water from the water trap. If the problem still occurs, replace the water trap with a new one.
			The sampling line is clogged.	Check that sampling line is not bent or clogged. Replace with a new one if necessary.
			The exhaust gas tube is clogged.	Check that exhaust gas tube is not bent or clogged. Replace with a new one if necessary.
*	GAS CHECK EXTERNAL DEVICE	GAS	Measure switch on the unit is turned off.	Turn on the measure switch on the unit.
			The connection cable is disconnected from the monitor.	Check the connection between the unit and the monitor.
			An error occurs in the communication between the unit and monitor.	Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative. When using an AG-920R multigas unit, refer to the QF-904P interface manual.
		GAS GF-210R/220R	The power cord is disconnected.	Check the power cord is securely connected.
		GAS GF-110PA/120PA GF-210R/220R	<GAS MEASUREMENT> on the GAS window is OFF.	Set the <GAS MEASUREMENT> on the GAS window to ON.
*	GAS CHECK SAMPLE LINE	GAS AG-920R	The sampling gas inlet on the water trap or sampling gas outlet on the rear panel of the unit is pressurized.	Check that the sampling gas inlet or sampling gas outlet of the unit is not pressurized.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	GAS CHECK WATERTRAP	GAS	The water trap is not attached properly. The sampling line is not connected properly.	Make sure that the water trap is securely attached to the unit. Connect the sampling line properly.
		GAS GF-210R/220R	An unspecified sampling line is used.	Use a specified sampling line.
*	GAS EXTERNAL DEVICE ERROR	GAS	Faulty unit.	Contact your Nihon Kohden representative.
*	GAS LINE BLOCK	GAS	The water trap is clogged.	Empty the water from the water trap. If the problem still occurs, replace the water trap with a new one.
			The sampling line is clogged.	Check that sampling line is not bent or clogged. Replace with a new one if necessary.
			The exhaust gas tube is clogged.	Check that exhaust gas tube is not bent or clogged. Replace with a new one if necessary.
*	GAS MIXED GAS	GAS	Two anesthetic agents are detected at the same time when the vaporizer is changed.	When either agent concentration becomes below 0.2% or alarm silences.
			Wrong agent is delivered to the vaporizer.	Contact the anesthetic machine manufacturer.
			Two anesthetic agents are detected when two vaporizers operated at the same time.	
–	GAS OUT OF RANGE	GAS	The measured value is outside the measurable range.	• Check the condition of the patient and anesthetic machine. • Check the connection of the sampling line and respiration circuit. • Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative.
			The measurement sensitivity has shifted.	Perform gas calibration with the correct gas.
*	GAS OVERHEAT	GAS GF-210R/220R	Faulty fan.	Contact your Nihon Kohden representative.
–	GAS PURGING	GAS AG-920R	Purging to remove clogging from the sampling line.	Wait for purging to complete.
–	GAS UNSPECIFIED ACCURACY	GAS AG-920R	The measured value is outside the accuracy range.	• Check the condition of the patient and anesthetic machine. • Check the connection of the sampling line and respiration circuit. • Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative.
			The measurement sensitivity has shifted.	Peform gas calibration with the correct gas.
–	GAS WARMING UP	GAS	The unit is still warming up.	Wait for warming up to complete.
*	INPUT UNIT DISCONNECT	System	The input unit is disconnected from the main unit or data acquisition unit when the transport function is enabled.	Connect the input unit and authenticate the patient on the SELECT PATIENT DATA window to select the monitoring patient.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	INPUT UNIT FAILURE	System	Communication error between the input unit and main unit.	Insert and remove the input unit from the bedside monitor. If the problem is not solved, contact your Nihon Kohden representative
			The QM-600P memory unit installed inside the input unit is damaged.	
			The data is sent to a bedside monitor or central monitor which has a different time zone setting and data in the input unit is deleted.	Insert and remove the input unit from the bedside monitor or JA-690PA/694PA data acquisition unit and press the [Silence Alarms] key. Make sure to change the zone setting to the same setting as the other bedside monitors or central monitors.
–	INSERT REC PAPER	Recording	No recording paper.	Load the recording paper.
			The recording paper is not loaded correctly.	Correctly load the recording paper.
–	INVALID CARD	System	Invalid SD card is inserted.	Only use the Nihon Kohden specified SD card.
–	MONITOR OFF	All parameters	Monitor cannot access to interbed bed.	The power of interbed bed is off.
				The network cable of interbed bed side is disconnected.
*	MPU MODULE ERROR	All parameters	MPU circuit malfunction.	Contact your Nihon Kohden representative.
*	MULTILINK CONFIG ERROR	All parameters	Communication failure between QF series interface or IF series communication cable and monitor.	Contact your Nihon Kohden representative.
*	MULTILINK POWER ERROR	All parameters	Multi-link power supply failure.	Contact your Nihon Kohden representative.
*	NIBP AIR LEAK	NIBP	The cuff pressure does not change after inflation even after a certain period of time.	Connect the cuff to the air hose properly.
				Connect the air hose to the socket properly.
			The cuff or air hose is damaged.	Replace the cuff or air hose with a new one.
*	NIBP CANNOT DETECT PULSE	NIBP	The patient's pulse wave is small.	Measure by palpation or the invasive blood pressure method.
			The cuff is not wrapped on the patient correctly.	Wrap the cuff around the arm of the patient properly.
*	NIBP CHECK INTERVAL SETTING	NIBP	NIBP is measured at 1 minute intervals for more than 30 minutes.	Check the patient condition and determine whether to continue measuring NIBP at 1 minute intervals.
*	NIBP CONNECTOR OFF	NIBP	The air hose is disconnected from the monitor.	Connect the air hose properly. When NIBP monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The air hose is damaged.	Replace the air hose with a new one.
*	NIBP CUFF OCCLUSION	NIBP	The cuff pressure does not decrease after measurement has completed.	Check that the air hose is not bent or squeezed.
*	NIBP HIGH CUFF PRESS	NIBP	Enormous pressure was applied by the pressure of the cuff.	When measuring an adult, ask the patient not to move too much.
–	NIBP INFLATION PRESS LOW	NIBP	Insufficient cuff inflation pressure.	Wait until the cuff pressure rises.
*	NIBP MEAS TIMEOUT	NIBP	The measuring time exceeded the specified time due to arrhythmia or noise.	If the cause is arrhythmia, measure by invasive blood pressure measurement. Remove the cause if due to noise.
–	INFLATION TIME PASSED	NIBP	Venous puncture cuff inflation time is exceeded.	Restart venous puncture.

	Screen Message	Parameter	Possible Cause/Criteria	Action
–	NIBP MEASURING NIBP	NIBP	Start venous puncture during NIBP.	Finish the NIBP measurement and restart venous puncture.
*	NIBP MODULE ERROR	NIBP	Module malfunction.	Contact your Nihon Kohden representative.
–	NIBP PLEASE WAIT	NIBP	Measurement started before the cuff inflation pressure was deflated enough.	Check the cuff pressure before starting measurements. When measuring using the adult cuff: below 15 mmHg When measuring using the cuff for neonates: below 3 mmHg
–	NIBP REMEASURING (Remeasurement is automatically performed. If the message still appears, after remeasurement, do the counter actions.)	NIBP	The cuff is not attached to the patient.	Attach the cuff to the patient.
			Patient moved during measurement.	Wait for the patient to stop moving, then measure again.
			Patient's pulse is too small.	Measure by palpation or the invasive blood pressure method.
			The cuff is not attached properly.	Attach the cuff properly.
			The cuff size is not appropriate.	Check that the cuff of the correct size is used.
			Patient's pulse and heart rate is unstable.	Wait for the patient to relax and stop moving.
*	NIBP SAFETY CIRCUIT RUNNING (When this message is displayed, measurement cannot be performed for 40 seconds.)	NIBP	The hose is bent.	Check that the hose is not bent.
			The inflation time is too long.	Stop measurement.
			In auto mode measurement, the cuff inflation started before the cuff deflation is complete.	Stop measurement.
*	NIBP SYSTOLIC OVER	NIBP	The maximum blood pressure exceeded 280 mmHg when using the adult cuff, or 150 mmHg when using the neonate cuff.	Measure by palpation or the invasive blood pressure method.
–	NIBP WEAK PULSE	NIBP	The patient's pulse wave is too small.	Measure by palpation or the invasive blood pressure method.
			The cuff is wrapped too loosely.	Wrap the cuff around the arm properly.
			The cuff size is inappropriate.	Use the appropriate cuff.
–	NIBP ZEROING	NIBP	NIBP zero balance adjustment is being performed.	Do not touch the cuff during zeroing and wait for the message to disappear.
–	O_2 CAL??	O_2	The oxygen sensor is not calibrated.	Calibrate the oxygen sensor.
			The oxygen sensor has reached the end of its life.	Replace the oxygen sensor with a new one.
			The oxygen sensor is not connected properly.	Check the connection of the oxygen sensor, wait for more than 1 minute and then calibrate again. If the problem still occurs, replace the oxygen sensor with a new one.
			Calibration is performed when the oxygen sensor is not stable.	
			The calibration mode is not appropriate.	Select the correct calibration mode.
–	O_2 CALIBRATING	O_2	Calibrating the oxygen sensor.	Wait for the calibration to be connected.
*	O_2 CONNECTOR OFF	O_2	The FiO_2 connection cord is disconnected from the monitor.	Connect theFiO_2 connection cord properly. When O_2 monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The FiO_2 connection cord is damaged.	Replace the FiO_2 connection cord with a new one.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	O_2 CHECK SENSOR	O_2	The oxygen sensor is disconnected from the FiO$_2$ connection cord.	Connect the oxygen sensor to the FiO$_2$ connection cord properly.
			The FiO$_2$ connection cord is damaged.	Replace the FiO$_2$ connection cord with a new one.
			The oxygen sensor is damaged.	Replace the oxygen sensor with a new one.
*	PARAMETER NOT AVAILABLE	All parameters	Connected cord or cable of the parameter is not available on the monitor.	—
*	PCCO CHECK EXTERNAL DEVICE	PiCCO	The PiCCO monitor is disconnected from the bedside monitor.	Check the interface connection between the PiCCO monitor and the bedside monitor.
*	PRESS CHECK SENSOR	IBP	The blood pressure transducer is disconnected from the IBP connection cord.	Connect the blood pressure transducer to the IBP connection cord properly.
			Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
			The IBP connection cord is damaged.	Replace the IBP connection cord with a new one.
*	PRESS CONNECTOR OFF	IBP	The IBP connection cord is disconnected from the monitor.	Connect the IBP connection cord properly. When IBP monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The IBP connection cord is damaged.	Replace the IBP connection cord with a new one.
–	PRESS OUT OF RANGE	IBP	The measured value is outside the measuring range.	Check the measuring environment.
			Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
*	PRESS THIS LABEL IS ALREADY REGISTERED	IBP	More than one IBP connection cord with the same label are used.	Set another label.
–	PRESS ZERO CALIBRATING	IBP	Zero balance adjustment is performed.	Wait for the zero balance adjustment to complete.
–	PRESS ZERO IMBALANCE	IBP	Zero balance is not adjusted.	Adjust the zero balance.
–	PRESS ZERO OUT OF RANGE	IBP	Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
			Monitor malfunction.	Contact your Nihon Kohden representative.
–	PRESS ZERO UNSTABLE	IBP	The circuit is not exposed to air during zero balance adjustment.	Expose the circuit to air and perform zero balance adjustment again.
			The pressure of zero balance is unstable.	Re-connect the circuit and perform zero balance adjustment again.
–	PRESS ZEROING COMPLETE	IBP	Zero balance adjustment is complete.	IBP monitoring is available.
*	PRINT ERROR	Print	Too many print commands are sent to the network printer.	Wait a while and print again.
			Printer settings are not correct.	Correctly set the printer setting on the PRINTER window on the SYSTEM CONFIGURATION screen.
			The recording paper is not loaded correctly.	Correctly load the recording paper.
–	PRINTING	System	Data is sent to the network printer.	—
*	RESP CHECK SENSOR	RESP (Thermistor)	The respiration pickup is damaged.	Replace the respiration pickup with a new one.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	RESP CONNECTOR OFF	RESP (Thermistor)	The respiration pickup is disconnected from the monitor.	Connect the respiration pickup properly. When respiration monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The respiration pickup is damaged.	Replace the respiration pickup with a new one.
–	RESP OFF	RESP (Impedance)	<IMP RESP MEASURE> on the RESP/CO_2 window is set to OFF.	When monitoring respiration by impedance method is necessary, set <IMP RESP MEASURE> to ON.
–	SENDING DATA	System	The input unit is removed from a bedside monitor and connected to another bedside monitor in a central monitor network. The data of the source bedside monitor is sent to the central monitor.	—
–	SIMULATED DATA	All parameters	The displayed data is simulated data.	To monitor a patient, set <SIMULATION MODE> to OFF on the SYSTEM CONFIGURATION screen. (Administrator setting)
*	SpO_2-2 ALARM	SpO_2-2 (Nellcor/ Masimo)	Alarm occurring on the pulse oximeter.	Look at the pulse oximeter and remove the cause of the alarm.
*	SpO_2 CANNOT DETECT PULSE	SpO_2 (NK)	Poor blood circulation for measuring the SpO_2 value.	Check the patient condition, probe attachment or change the attachment site.
			The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
			One of the following message is displayed for 30 seconds. • SpO_2 LIGHT INTERFERENCE • SpO_2 CHECK PROBE SITE • SpO_2 DETECTING PULSE	Refer to the each screen message section and remove the cause of the alarm or message.
		SpO_2 (Nellcor)	The pulse waveform cannot be detected.	Attach the probe to the patient properly.
*	SpO_2-2 CANNOT DETECT PULSE	SpO_2 (NK)	Poor blood circulation for measuring the SpO_2 value.	Check the patient condition, probe attachment or change the attachment site.
			The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
			One of the following message is displayed for 30 seconds. • SpO_2-2 LIGHT INTERFERENCE • SpO_2-2 CHECK PROBE SITE • SpO_2-2 DETECTING PULSE	Refer to the each screen message section and remove the cause of the alarm or message.
*	SpO_2 CHANGE PROBE	SpO_2 (NK)	Probe is past its expiration date.	Replace the probe with a new one.
			Probe is damaged or short-circuited.	Replace the probe with a new one.
			SpO_2 connection cord is damaged.	Replace the SpO_2 connection cord with a new one.
		SpO_2 (Masimo)	The monitor cannot identify the connected probe or the probe is broken.	Replace the probe. Refer to the probe manual.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	SpO_2-2 CHANGE PROBE	SpO_2 (NK)	Probe is past its expiration date.	Replace the probe with a new one.
			Probe is damaged or short-circuited.	Replace the probe with a new one.
			SpO_2 adapter is damaged.	Replace the SpO_2 adapter with a new one.
*	SpO_2-2 CHECK EXTERNAL DEVICE	SpO_2-2 (Nellcor/ Masimo)	The pulse oximeter is disconnected from the bedside monitor.	Check the communication cable connection between the pulse oximeter and bedside monitor.
			Communication error between the bedside monitor and pulse oximeter.	Check the communication settings and the communication cable connection. Refer to the communication cable manual.
*	SpO_2 CHECK PROBE	SpO_2 (NK)	The probe cable is disconnected from the SpO_2 connection cord.	Connect the probe cable to the SpO_2 connection cord. If SpO_2 monitoring is not necessary, press the [Silence Alarms] key.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
			The probe is broken or short-circuited.	Replace the probe with a new one. If the message still appears, replace the SpO_2 connection cord with a new one.
		SpO_2 (Nellcor/ Masimo)	The probe is not attached to the patient properly.	Attach the probe to the patient properly.
*	SpO_2-2 CHECK PROBE	SpO_2 (NK)	The probe cable is disconnected from the SpO_2 adapter.	Connect the probe cable to the SpO_2 adapter. If SpO_2 monitoring is not necessary, press the [Silence Alarms] key.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
			The probe is broken or short-circuited.	Replace the probe with a new one. If the message still appears, replace the SpO_2 adapter with a new one.
*	SpO_2 CHECK PROBE SITE	SpO_2 (NK)	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
			Probe is past its expiration date.	Replace the probe with a new one.
*	SpO_2-2 CHECK PROBE SITE	SpO_2 (NK)	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
			Probe is past its expiration date.	Replace the probe with a new one.
*	SpO_2 CONNECTOR OFF	SpO_2 (NK/Nellcor/ Masimo)	The probe cable is disconnected from the SpO_2 connection cord.	Connect the probe cable to the SpO_2 connection cord. If SpO_2 monitoring is not necessary, press the [Silence Alarms] key.
			The SpO_2 connection cord is disconnected from the SpO_2 socket.	Connect the SpO_2 connection cord properly. When SpO_2 monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		SpO_2 (Masimo)	The probe is not connected to the patient cable correctly.	Connect the probe to the patient cable with the logo labels facing the same direction.
			The monitor cannot identify the connected probe.	Replace the probe. Refer to the probe manual.

	Screen Message	Parameter	Possible Cause/Criteria	Action
*	SpO_2-2 CONNECTOR OFF	SpO_2 (NK)	The probe cable is disconnected from the SpO_2 adapter.	Connect the probe cable to the SpO_2 adapter. If SpO_2 monitoring is not necessary, press the [Silence Alarms] key.
			The SpO_2 adapter is disconnected from the SpO_2 socket.	Connect the SpO_2 adapter properly. When SpO_2 monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
–	SpO_2 DETECTING PULSE	SpO_2 (NK/Nellcor/ Masimo)	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
		SpO_2 (NK)	The SpO_2 value cannot be obtained because the waveform is unstable.	Check the probe attachment.
			Poor blood circulation for measuring SpO_2.	Check the patient condition, probe attachment or change the attachment site.
			The probe is secured too tightly and is obstructing the blood circulation.	Reattach the probe.
			The probe is disconnected from the SpO_2 connection cord.	Connect the probe to the SpO_2 connection cord.
			The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
		SpO_2 (Nellcor/ Masimo)	The probe attachment site is not appropriate.	Attach the probe to an appropriate place.
–	SpO_2-2 DETECTING PULSE	SpO_2 (NK)	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
			The probe is not attached to the patient properly.	Attach the probe to the patient properly.
			The SpO_2 value cannot be obtained because the waveform is unstable.	Check the probe attachment.
			Poor blood circulation for measuring SpO_2.	Check the patient condition, probe attachment or change the attachment site.
			The probe is secured too tightly and is obstructing the blood circulation.	Reattach the probe.
			The probe is disconnected from the SpO_2 adapter.	Connect the probe to the SpO_2 adapter.
			The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
*	SpO_2-2 ERROR	SpO_2-2 (Nellcor/ Masimo)	There is an error on the pulse oximeter.	Look at the pulse oximeter screen and remove the cause of the error.
*	SpO_2 LIGHT INTERFERENCE	SpO_2 (Masimo)	Too much light on the probe.	Remove light or cover the probe site with blanket.
			Interference from surroundings.	Remove the interference.
			The probe attachment site is not appropriate.	Attach the probe to an appropriate site.

Screen Message		Parameter	Possible Cause/Criteria	Action
–	SpO_2 LOW QUALITY SIGNAL	SpO_2 (NK/Nellcor/ Masimo)	Considerable body movement.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
			The probe is not attached to the patient properly.	
		SpO_2 (Nellcor)	Low signal IQ.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
–	SpO_2-2 LOW QUALITY SIGNAL	SpO_2 (NK)	Considerable body movement.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
			The probe is not attached to the patient properly.	
*	SpO_2 MODULE ERROR	SpO_2 (NK/Nellcor/ Masimo)	SpO_2 hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden representative.
*	SpO_2-2 MODULE ERROR	SpO_2 (NK)	SpO_2 hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden representative.
–	SpO_2 WEAK PULSE	SpO_2 (NK/Masimo)	Poor peripheral circulation.	Check the patient condition and change the attachment site.
			The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
		SpO_2 (Masimo)	Low perfusion.	Check the patient condition and change the attachment site.
–	SpO_2-2 WEAK PULSE	SpO_2 (NK)	Poor peripheral circulation.	Check the patient condition and change the attachment site.
			The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
*	$tcPO_2/PCO_2$ ALARM	$tcPO_2/PCO_2$	Alarm occurring on the transcutaneous monitor.	Look at the transcutaneous monitor and remove the cause of the alarm.
*	$tcPO_2/PCO_2$ CHECK EXTERNAL DEVICE	$tcPO_2/PCO_2$	The transcutaneous monitor is disconnected from the bedside monitor.	Check the communication cable connection between the transcutaneous monitor and bedside monitor.
			Communication error between the bedside monitor and transcutaneous monitor.	Check the communication settings and the communication cable connection. Refer to the communication cable manual.
*	TEMP CHECK SENSOR	TEMP	The probe is disconnected from the TEMP socket or temperature connection cord is disconnected from the MULTI socket.	Connect the probe to the TEMP socket or the temperature connection cord to the MULTI socket properly.
			The probe or temperature connection cord is damaged.	Replace the probe or temperature connection cord with a new one.
			The measured value is outside the measuring range.	Check the probe attachment site.
*	TEMP CONNECTOR OFF	TEMP	The temperature connection cord is disconnected from the monitor.	Connect the temperature connection cord properly. When temperature monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The temperature connection cord is damaged.	Replace the temperature connection cord with a new one.
*	TEMP THIS LABEL IS ALREADY REGISTERED	TEMP	More than one temperature probe with the same label are used.	Set another label.

Screen Message		Parameter	Possible Cause/Criteria	Action
*	TOF CHECK EXTERNAL DEVICE	TOF	The TOF-watch® SX is disconnected from the monitor.	Check the interface connection between the TOF-watch® SX and monitor.
*	TOF ALARM	TOF	There is an error on the TOF-watch® SX.	Check the TOF-watch® SX screen and remove the cause of the error.
*	TRANSMITTER CONNECTOR OFF	System	The connection cord of the transmitter is disconnected from the monitor.	Connect the connection cord properly.
–	UPDATING DATA	All parameters	Changing the parameter on the trend screen.	Wait until the message disappears.
*	VENT ALARM	VENT	Alarm occurring on the ventilator.	Check the ventilator and remove the cause of the alarm.
*	VENT CHECK EXTERNAL DEVICE	VENT	The ventilator is disconnected from the monitor.	Check the interface or communication cable connection between the ventilator and the monitor.

Troubleshooting

For troubleshooting in use, refer to the operator's manual.

Power-related Problems

Problem	Possible Cause/Criteria	Action
The instrument does not turn on in AC power operation and the AC power lamp lights.	MAIN DIGITAL board, FRONT IF board or Power SW board failure.	Replace the MAIN DIGITAL board, FRONT IF board or Front Mother board set with a new one. When replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to "Calibrating the Touch Panel" in Section 3.
The instrument does not turn on in AC power operation and the AC power lamp does not light.	AC line voltage or power cord failure.	• Check the AC line voltage. • Replace the power cord.
	Poor contact at either connector of the cable between the AC inlet and power supply unit or failure in the cable.	Check the cable between AC inlet and power supply unit or replace the cable.
	Power supply unit failure.	Replace the power supply unit.
	Poor contact at either connector of the cable between the power supply unit and MAIN DIGITAL board or failure in the cable.	Check the cable between the power supply unit and MAIN DIGITAL board or replace the cable.
	Poor contact at either connector of the cable between the MAIN DIGITAL board and FRONT IF board or failure in the cable.	Check the cable between the MAIN DIGITAL board and FRONT IF board or replace the cable.
	Poor contact at either connector of the cable between the FRONT IF board and Power SW board or failure in the cable.	Check the cable between the FRONT IF board and Power SW board or replace the cable.
	MAIN DIGITAL board, FRONT IF board or Power SW board failure.	Replace the MAIN DIGITAL board, FRONT IF board or Front Mother board set with a new one.
The instrument does not turn on in battery operation.	Rechargeable battery is weak.	Charge the battery.
	Battery failure or battery life expired.	Replace the battery with a new one.
	Poor contact at either connector of the two cables between the BATT MOTHER 0 and MAIN DIGITAL boards or failure in the two cables.	Check each connector or replace the cable.
	Poor contact at either connector of the two cables between the BATT MOTHER 1 and MAIN DIGITAL boards or failure in the two cables.	Check each connector or replace the cable.
	MAIN DIGITAL, BATT MOTHER 0 or BATT MOTHER 1 board failure.	Replace the MAIN DIGITAL, BATT MOTHER 0 or BATT MOTHER 1 board with a new one.

Problem	Possible Cause/Criteria	Action
Battery operation time is shorter than expected.	Battery life expired.	Replace the battery with a new one.
	Memory effect in battery.	Fully charge the battery for 2 or 3 times after fully discharging the battery. If the problem is still there, replace the battery with a new one.
	Charging circuit failure.	Replace the MAIN DIGITAL board with a new one.

Display Problems

Problem	Possible Cause/Criteria	Action
Nothing is displayed and AC power lamp does not light.	Power cord is loose.	Check that the power cord is firmly connected.
	Power supply unit failure.	Replace the power supply unit.
Nothing is displayed, AC power lamp lights and power lamp does not light.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	Failure in the cable between the FRONT IF and Power SW boards.	Replace the cable.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Nothing is displayed and AC power lamp and power lamp both light.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	LVDS cable failure.	Replace the LVDS cable.
	LCD unit failure.	Replace the LCD unit.
	Inverter board failure.	Replace the Inverter board.
	Failure in the cable between the Inverter board and MAIN DIGITAL board.	Replace the cable.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Abnormal screen is displayed.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	LVDS cable failure.	Replace the LVDS cable.
	LCD unit failure.	Replace the LCD unit.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.

Alarm Indicator Problem

Problem		Possible Cause/Criteria	Action
LEDs do not light.	Some LEDs light by using “ALARM” function on the MANUAL CHECK screen.	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
	Some LEDs do not light by using “ALARM” function on the MANUAL CHECK screen.	Alarm board or MAIN DIGITAL board failure.	Replace the Front Mother board set or MAIN DIGITAL board.

Sound Problems

Problem	Possible Cause/Criteria	Action
No sound or small volume even if you increase the sound volume in the VOLUME window selected on the MENU window.	Speaker failure.	Replace the speaker.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Sound is distorted even if you try various sounds by using “SOUND” function on the MANUAL CHECK screen.	Speaker failure.	Replace the speaker.
	Object in front of the speaker.	Remove the object.

Key Operation Problems

Problem		Possible Cause/Criteria	Action
CHECK key does not work.		Key top cover is broken.	Replace the key top cover.
		MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Active area for a key does not match the key display on the screen.	The mark appears under your finger when you press a position on the screen by using “TOUCH KEY” function on the MANUAL CHECK screen. When you release the finger from the screen, the mark returns to a particular position. In other words, the particular position is always pressed.	Foreign object between the touch screen and front panel.	Remove the foreign object.
		The edge protection rubber is not properly attached to the touch screen.	Remove the rubber from the touch screen and reattach it to the touch screen properly.
		Touch screen failure.	Replace the touch screen.
	The mark appears under your finger when you press a position on the screen by using “TOUCH KEY” function on the MANUAL CHECK screen. When you release the finger from the screen, the mark stays around the position but it is always out of the acceptable range.	The touch screen was not calibrated after replacement.	Calibrate the touch screen.
		Touch screen failure.	Replace the touch screen.
		MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.

Recording Problems

Problem	Possible Cause/Criteria	Action
Nothing is recorded on the paper but the model number “WS-671P” is displayed on the INFO page of the SYSTEM SETUP window.	Recording paper in the wrong position in the magazine.	Load the paper into the magazine properly.
	The heat-sensitive side of the paper is not facing the thermal array head.	Load the paper into the magazine properly.
	If the recorder door is firmly closed but the “CLOSE PAPER MAGAZINE” message and icon are still displayed: Mechanical failure in recorder module.	Replace the RG-501X paper drive unit.
	If paper is properly set into the magazine and the recorder door is firmly closed but the “INSERT REC PAPER” message is still displayed: • Dirty paper sensor or failure in the sensor or related circuit of the recorder.	• Clean the paper sensor with a cotton swab. Refer to operator’s manual. • Replace the RG-501X paper drive unit or WS-671P recorder module.
	If waveforms and numeric data can be recorded on the paper when you pull out the paper after touching the Record key on the screen: • RG-501X paper drive unit or WS-671P recorder module failure.	Replace the RG-501X paper drive unit or WS-671P recorder module.
Nothing recorded on the paper and the model number “WS-671P” is not displayed on the INFO page of the SYSTEM SETUP window.	Recorder module failure.	Replace the WS-671P recorder module.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Page-dependent recording such as trend graph and vital sign list does not start at the top of the page.	Recording paper in the wrong position in the magazine.	Load the paper into the magazine properly so that each black square mark on the paper is detected.
	Dirty mark sensor.	Clean the mark sensor with a cotton swab. Refer to operator's manual.
	Failure in the mark sensor or related circuit of the recorder.	Replace the RG-501X paper drive unit or WS-671P recorder module.
Garbled numeric data on the paper.	Failure in the Recorder board of the recorder module.	Replace the WS-671P recorder module.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Waveforms and numeric data are distorted because the paper speed is unstable.	Platen roller or gears are dusty or damaged.	Clean the platen roller and gears. If the problem is still there, replace the YS-086P9 Magazine door assy.
	Unstable motor rotation.	Replace the RG-501X paper drive unit or MAIN DIGITAL board.
Waveforms and grid have faint parts.	Dirt on the thermal array head.	Clean the thermal array head.
	Thermal array head is improperly attached.	Remove the thermal array head and reattach it properly.
	Recorder door is not firmly closed.	Close the recorder door firmly.
	Thermal array head failure.	Replace the thermal array head.
	Recorder module failure.	Replace the WS-671P recorder module.

Network Communication Problem

Problem	Possible Cause/Criteria	Action
Cannot communicate with the network.	If BSM-6000 is connected to a PC with a cross network cable and ping response is not returned to the PC: • MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
	If BSM-6000 is connected to a PC with a cross network cable and ping response is returned to the PC: • Hub and cables have problems.	Check the hub and cables in the network.

SD Card Problem

Problem	Possible Cause/Criteria	Action
SD card error is displayed.	SD card is not inserted properly.	Remove then re-insert the SD card into the slot.
	SD card failure.	Replace the SD card.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.

Communication Problems with Optional Units or External Equipment

Problem	Possible Cause/Criteria	Action
Cannot recognize an AY-600P series input unit.	AY-600P series input unit failure.	Replace the input unit.
	Failure in the cable between the INPUT IF and MAIN DIGITAL boards.	Replace the cable.
	INPUT IF board failure.	Replace the INPUT IF board.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Cannot communicate with an optional unit through a multilink port on the optional interface and “MULTILINK CONFIG ERROR” message is displayed.	Optional unit failure.	Replace the unit with a new one.
	Optional interface failure.	Replace the interface with a new one.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board with a new one.
Cannot communicate with an optional unit through a multilink port on the optional interface and “MULTILINK POWER ERROR” message is displayed.	Optional unit failure.	Replace the unit with a new one.
	Interface failure.	Replace the interface with a new one.

Problem	Possible Cause/Criteria	Action
Cannot communicate with an optional unit or external equipment through a multilink port on the optional interface and no error message is displayed.	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Interface or MAIN DIGITAL board failure.	• Replace the interface with a new one. • Replace the MAIN DIGITAL board.
	If a port does not display the model number of the optional unit connected to the port on the MULTILINK CHECK screen in the MANUAL CHECK mode: • Failure in the optional unit connected to this port or in the interface.	• Replace the optional unit with a new one. • Replace the interface with a new one.
	If no ports display the model numbers of the optional units connected to the ports on the MULTILINK CHECK screen in the MANUAL CHECK mode: • Interface or MAIN DIGITAL board failure.	• Replace the interface with a new one. • Replace the MAIN DIGITAL board with a new one.
	If all ports display the model numbers of the optional units or external equipment connected to the ports on the MULTILINK CHECK screen in the MANUAL CHECK mode: • MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board with a new one.
Cannot communicate with an external equipment through an RS-232C port on the optional interface.	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Wrong baud rate setting or connection cable failure.	• Set the baud rate properly. • Replace the connection cable if there is a poor contact or break in the cable or the cable is not cross type.
	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Interface or MAIN DIGITAL board failure.	Replace the interface or MAIN DIGITAL board.

Problem	Possible Cause/Criteria	Action
USB mouse does not work.	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and the LED of an optical mouse lights: • MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and the LED of an optical mouse does not light: • Mouse, interface or MAIN DIGITAL board failure.	• Replace the mouse with a new one. • Replace the interface with a new one. • Replace the MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Interface or MAIN DIGITAL board failure.	• Replace the interface with a new one. • Replace the MAIN DIGITAL board with a new one.
Vital sign waveforms cannot be transmitted to a receiver with a ZS-900P transmitter.	If the transmitter LED does not turn on: • Poor contact between instrument and transmitter or failure in the transmitter or MAIN DIGITAL board. If the LED lights in red: • Transmitter or MAIN DIGITAL board failure.	• Firmly connect the transmitter cable to the instrument. • Replace the transmitter with a new one. • Replace the MAIN DIGITAL board.
Nothing is displayed on an external display.	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Poor contact or break in the display cable or failure in the display, interface or MAIN DIGITAL board.	• Firmly connect the display cable between the instrument and display or replace the display cable with a new one. • Replace the display, interface or MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Interface or MAIN DIGITAL board failure.	Replace the interface or MAIN DIGITAL board with a new one.

Problem	Possible Cause/Criteria	Action
Alarm information of a bedside monitor is not output from the nurse call system.	If QI-632P or QI-671P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and alarm signals are not output on the INDICATOR CHECK in MANUAL CHECK mode: • Short circuit in the YJ-672P nurse call cable or failure in the interface or MAIN DIGITAL board.	Replace the nurse call cable, interface or MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: • Interface or MAIN DIGITAL board failure.	Replace the interface or MAIN DIGITAL board with a new one.

Problems in ECG Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure ECG and "ECG MODULE ERROR" is displayed.	If ECG can be measured after disconnecting the ECG connection cord and removing then reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If ECG cannot be measured after disconnecting the ECG connection cord and removing then reattaching the input unit to the main unit: • Input unit failure.	Replace the input unit with a new one.
ECG waveform does not appear on the screen.	If "ECG CHECK ELECTRODES" is displayed: • Failure in the path from patient to ECG input socket. – The electrode peels or the gel of the electrode is dry. – High contact impedance between the electrode and the skin. – Instrument is not properly grounded. – ECG connection cord is not firmly connected. – ECG connection cord failure. • Number of electrodes is set incorrectly on the instrument.	 – Replace the electrodes. – Perform the skin preparation before attaching the electrode. – Ground the instrument properly. – Firmly connect the ECG connection cord between the input socket and electrode lead wires. – Replace the ECG connection cord. • Properly set the number of electrodes actually used.
	If none of the above problems are found and "ECG CHECK ELECTRODES" is still displayed after you short-circuit all the electrode lead wires: • Input unit failure.	Replace the input unit with a new one.

Problem	Possible Cause/Criteria	Action
Heart rate not counted correctly and “ECG NOISE” is displayed.	Failure in the path from patient to ECG input socket. • The electrode peels or the gel of the electrode is dry. • A baseline drift or EMG is on the ECG due to body movement. • High contact impedance between the electrode and skin. • The instrument is not properly grounded.	• Replace the electrodes. • Attach new electrodes to different positions so that the affection of body movement is reduced. • Perform the skin preparation before attaching the electrode. • Ground the instrument properly.
	If none of the above problems are found and “ECG NOISE” is still displayed after you short-circuit all the electrode lead wires: • Input unit failure.	Replace the input unit.
Heart rate not counted correctly and heart rate is not accurate.	Patient has a pacemaker but pacing detection is set to OFF.	Set the pacing detection to ON.
	Patient’s condition has changed, and current ECG template is different from the previous ECG reference template.	Perform “Learning ECG.”
	High frequency noise on the ECG waveform when an electrosurgical unit (ESU) is used.	Reduce the high frequency noise by changing the positions of electrodes and return plate. Refer to “Use with an Electrosurgical Unit” in “ECG Monitoring” of the User’s Guide Part II.
	If frequent pacing marks appear on the ECG: • Instrument not properly grounded. • Electric blanket not shielded. • If none of the above problems are found and the baseline is unstable after you short-circuit all the electrode lead wires: − Input unit failure.	• Ground the instrument properly. • Use a shield cover. • Replace the input unit.

Problems In Respiration (Impedance Method) Measurement

Problem	Possible Cause/Criteria	Action
Impedance method respiration waveform does not appear and “RESP OFF” message is displayed on the screen.	Impedance method respiration measurement is set to OFF.	Set the <IMPEDANCE MEASUREMENT> in the RESP window to ON.

Problem	Possible Cause/Criteria	Action
Impedance method respiration waveform does not appear and "- - -" is displayed instead of the respiration rate (RR).	The electrode peels or the gel of the electrode is dry.	Replace the electrodes.
	Electrodes are not made by Nihon Kohden.	Use Nihon Kohden electrodes.
	High contact impedance between the electrode and skin.	Perform the skin preparation before attaching the electrodes to the patient.
	ECG connection cord is not properly connected.	Properly connect the ECG connection cord.
	Break in ECG connection cord.	Replace the ECG connection cord.
	If none of the above problems are found and the baseline is still unstable after you short-circuit all the electrode lead wires: • Input unit failure.	Replace the input unit.
Respiration rate on screen is different from manually counted respiration rate.	The electrode peels or the gel of the electrode is dry.	Replace the electrodes.
	Electrodes are not made by Nihon Kohden.	Use Nihon Kohden electrodes.
	High contact impedance between the electrode and skin.	Perform the skin preparation before attaching the electrodes to the patient.
	ECG connection cord is not properly connected.	Properly connect the cord.
	Break in ECG connection cord.	Replace the cord.
	Baseline drift due to body movement, or waveform synchronized with heartbeat is mixed in the respiration waveform.	• Select a lead from the ECG leads so that the affection is less than the others. • Change the positions of the two electrodes for respiration pickup so that the affection is less than the other positions. • Set the <NOISE REDUCTION ON IMPEDANCE RESP> in the SYSTEM SETUP window to ON.
	High frequency noise on the respiration waveform when an electrosurgical unit (ESU) is used.	Reduce the high frequency noise by changing the positions of electrodes and return plate. Refer to "Use with an Electrosurgical Unit" in "ECG Monitoring" of the User's Guide Part II.
	If none of the above problems are found and the baseline is still unstable after you short-circuit all the electrode lead wires: • Input unit failure.	Replace the input unit.

Problem in Invasive Blood Pressure (IBP) Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure IBP and "MPU MODULE ERROR" is displayed.	If IBP can be measured after disconnecting the IBP connection cord and removing then reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If IBP cannot be measured after disconnecting the IBP connection cord and removing then reattaching the input unit to the main unit: • Input unit* failure * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Cannot measure IBP, "---" is displayed and "PRESS CHECK SENSOR" message is displayed.	IBP connection cord or blood pressure transducer failure.	Replace the IBP connection cord or blood pressure transducer with a new one.
Cannot measure IBP, there is no error message, and blood pressure value is not displayed.	If IBP can be measured after connecting the IBP connection cord and blood pressure transducer to one of the other MP sockets: • MPU board or EXTMPU board failure	Replace the MPU board or EXTMPU board with a new one.
	If IBP cannot be measured after connecting the IBP connection cord and blood pressure transducer to one of the other MP sockets: • IBP connection cord or blood pressure transducer failure.	Replace the IBP connection cord or blood pressure transducer with a new one.
Zeroing (zero adjustment) is incomplete.	If "MPU MODULE ERROR" is displayed: • Refer to "Cannot be measured and MPU MODULE ERROR is displayed".	• Remove the cause of the noise. • Replace the input unit or smart expansion unit with a new one.
	If "PRESS CHECK SENSOR" is displayed: • Failure in IBP connection cord or blood pressure transducer.	Replace the IBP connection cord or blood pressure transducer with a new one.
	If "PRESS ZERO OUT OF RANGE" is displayed after zeroing: • Pressure less than –200 mmHg or more than +200 mmHg is applied to the transducer. • Transducer failure.	• Open the cock at the transducer and check that the transducer faces open air. • Replace the transducer with a new one.
	If "PRESS ZERO UNSTABLE" is displayed after zeroing: • Some pressure remains. • External pressure or vibration is applied to the blood circuit.	• Open the cock at the transducer and check that the transducer faces open air. • Remove the cause.

Problem	Possible Cause/Criteria	Action
Zeroing (zero adjustment) is incomplete.	If none of the above mentioned actions solve the problem but connecting the IBP connection cord and transducer to another MP socket solves the problem: • MPU board or EXTMPU board failure.	Replace the MPU board or EXTMPU board with a new one.
Noise on blood pressure waveform.	If an IBP connector of an AX-400G is connected to the MP socket, constant pressure is applied, and noise on the waveform trace is much more than 2 mmHg: • Input unit or smart expansion unit failure.	Replace the MPU board or EXTMPU board with a new one.
	If an IBP connector of an AX-400G is connected to the MP socket, constant pressure is applied, and noise on the waveform trace is around 1 to 2 mmHg: • Mechanical vibration.	Remove the cause of the noise.

Problem in Temperature (TEMP) Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure TEMP.	If another working temperature probe is connected to the input jack and the temperature value appears: • Probe failure.	Replace the temperature probe.
	If another working temperature probe is connected to the input jack and the temperature value does not appear: • Connector board or Analog board failure.	Replace the Connector board or Analog board.

Problems in Respiration (Thermister Method) Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure TEMP and "MPU MODULE ERROR" is displayed.	If respiration can be measured after disconnecting the MP connector of the respiration pickup and removing and reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If respiration cannot be measured after disconnecting the MP connector of the respiration pickup and removing and reattaching the input unit to the main unit: • Input unit* failure * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Cannot measure TEMP, "---" is displayed and "RESP CHECK SENSOR" message is displayed.	Respiration pickup failure.	Replace the pickup with a new one.
Cannot measure TEMP, no error message is displayed and no respiration rate is displayed.	If respiration can be measured after connecting the respiration pickup to one of the other MP sockets: • MPU board or EXTMPU board failure.	Replace the pickup with a new one.
	If respiration cannot be measured after connecting the respiration pickup to one of the other MP sockets: • Pickup failure.	Replace the pickup with a new one.

Problem in Oxygen Gas (O_2) Concentration Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure FiO_2 and "MPU MODULE ERROR" is displayed.	If FiO_2 can be measured after disconnecting the FiO_2 connection cord and removing then reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If FiO_2 cannot be measured after disconnecting the FiO_2 connection cord and removing then reattaching the input unit to the main unit: • FiO_2, input unit* failure * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Cannot measure FiO_2, "---" is displayed and "O_2 CHECK SENSOR" message is displayed.	FiO_2 connection cord or O_2 sensor failure.	Replace the FiO_2 connection cord or O_2 sensor with a new one.
Cannot measure FiO_2, no error message is displayed and no FiO_2 value is displayed.	If FiO_2 can be measured after connecting the FiO_2 connection cord and O_2 sensor to one of the other MP sockets: • MPU board or EXTMPU board failure.	Replace the MPU board or EXTMPU board with a new one.
	If FiO_2 cannot be measured after connecting the FiO_2 connection cord and O_2 sensor to one of the other MP sockets: • FiO_2 connection cord or O_2 sensor failure.	Replace the FiO_2 connection cord or O_2 sensor with a new one.
FiO_2 value is randomly unstable.	If the O_2 sensor is exposed to air and the FiO_2 value becomes stable: • Ventilator circuit failure.	Remove the cause from the ventilator circuit.
	If the O_2 sensor is exposed to air and the FiO_2 value is still unstable: • O_2 sensor failure.	Replace the O_2 sensor with a new one.
Cannot calibrate and "O_2 CAL??" is displayed.	If there is no problem with O_2 calibration gas and calibration cannot be done: • The O_2 sensor has reached the end of its life. • MPU board or EXTMPU board failure.	• Replace the O_2 sensor with a new one. • Replace the MPU board or EXTMPU board with a new one.

Problem in Cardiac Output (CO) Measurement

Problem	Possible Cause/Criteria	Action
CO, Tb and Ti temperatures cannot be measured and "MPU MODULE ERROR" is displayed.	If CO can be measured after disconnecting the CO connection cord and removing then reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If CO can be measured after disconnecting the CO connection cord and removing then reattaching the input unit to the main unit: • Input unit* failure. * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Tb and Ti cannot be measured, "---" is displayed and "CO CHECK SENSOR" message is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
CO, Tb and Ti cannot be measured and no error message is displayed.	If CO can be measured after connecting the CO connection cord and balloon catheter to one of the other MP sockets: • MPU board or EXTMPU board failure.	Replace the MPU board or EXTMPU board with a new one.
	If CO cannot be measured after connecting the CO connection cord and balloon catheter to one of the other MP sockets: • CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
Only Ti cannot be measured, "---" is displayed at Ti and "CO Ti TEMP ERROR" is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
	Injection liquid temperature outside measurable range.	Let the injection liquid temperature within the measurable range (0 to 27°C).
Only Tb cannot be measured, "---" is displayed at Tb and "CO Tb TEMP ERROR" is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
	Blood temperature outside measurable range.	Check that the blood temperature is in the measurable range (15 to 45°C).
CO cannot be measured and "CO BASELINE DRIFT" is displayed.	If the CO connector of an AX-400G is connected to the MP socket and the problem remains: • MPU board or EXTMPU board failure.	Replace the MPU board or EXTMPU board with a new one.
	If an AX-400G is connected and the problem disappears: • Physiological fluctuation or external noise interferes with the baseline.	Remove the cause of physiological fluctuation or cause of the noise.

Problems in Non-invasive Blood Pressure (NIBP) Measurement

Problem	Possible Cause/Criteria	Action
The display area for NIBP values does not appear after an air hose is connected.	Poor contact between air hose and red input socket.	Disconnect the air hose from the socket and reconnect the air hose to the socket tightly.
	Failure in the air hose.	Replace the air hose.
	If none of the above problems are found and the NIBP display area does not appear: • Input unit failure.	Replace the MPU board.
The NIBP display area appears and the cuff does not inflate.	When “NIBP SAFETY CIRCUIT RUNNING” message is displayed, the cuff inflation disables for 30 seconds.	Before starting the measurement after 30 seconds, check that there is no blockage in the cuff and air hose and no excessive pressure to the patient.
	If you touch the [NIBP Start/Stop] key and there is no pump sound: • Pump or pump drive circuit failure.	Replace the pump, AY MOTHER (INPUT MOTHER) board or MPU board with a new one.
The NIBP display area appears and the cuff inflates.	If you touch the [NIBP Start/Stop] key, there is a pump sound, and pressure does not reach the target pressure: • Air leak in the cuff or air hose. • Pneumatic circuit, valve or valve drive circuit failure.	• Replace the cuff or air hose. • Check each component of the pneumatic circuit and replace it if necessary. • Replace the valve or MPU board.
	If remeasurement starts after step deflation and finally “MEAS TIMEOUT” appears: • The cuff is not properly attached to the patient. • Vibration or external pressure on the cuff or air hose. • Failure in the oscillation signal amplification circuit of the MPU board.	• Attach the cuff to the patient properly. • Find any cause which can give vibration or pressure to the cuff or air hose, and remove the cause. • Replace the MPU board.

Problems in SpO_2 Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure SpO_2 and "SpO_2 MODULE ERROR" is displayed on the screen.	SpO_2 board, MPUPWR board or TEMP board failure.	Replace the SpO_2 board, MPUPWR board or TEMP board with a new one.
Cannot measure SpO_2 and "SpO_2 CONNECTOR OFF" or "SpO_2 CHECK PROBE" is displayed on the screen.	SpO_2 connection cord or SpO_2 probe failure.	Replace the SpO_2 connection cord or probe.
	If the problem remains after replacing the SpO_2 connection cord or probe: • SpO_2 board or MPUPWR board failure.	Replace the SpO_2 board or MPUPWR board with a new one.
Cannot measure SpO_2 and "SpO_2 WEAK PULSE" or "SpO_2 CANNOT DETECT PULSE" is displayed.	SpO_2 connection cord or SpO_2 probe failure.	Replace the SpO_2 connection cord or probe.
	If the message remains after replacing the SpO_2 connection cord and probe, connect an AX-400G vital sign simulator to the SpO_2 socket instead. If the messages disappear after connecting an AX-400G vital sign simulator to the SpO_2 socket: • The instrument and accessories have no problem.	Refer to "Screen Messages".
	If there is still a message after connecting an AX-400G vital sign simulator to the SpO_2 socket: • SpO_2 board or MPUPWR board failure.	Replace the SpO_2 board or MPUPWR board with a new one.

Error Code and History

The error history records the results of the self tests which are automatically executed when the power is turned on, and the errors which are detected while the monitor is in operation. The monitor saves the history of failures that occurred in the past, and retains it until the factory system initialization is executed.

Use the HISTORY screen of the DIAGNOSTIC CHECK screen to display the error history. Refer to the Section 3 "Displaying the DIAGNOSTIC CHECK screen" to display the DIAGNOSTIC CHECK screen.

Error codes displayed in the error history are listed below.

Error Code List

Large Classification	Details	Error Description
DIAG ERROR	FRAM Check: Manage Table Error.	Set value check error (an error was detected in the management area).
	FRAM Check: Setting Table Size Error.	Set value check error (an error was detected in the memory size check).
	FRAM Check: Setting Area1&2 Sum Error.	Set value check error (an error was detected in the SUM check).
	SETLIB: Keycode Err	There was a same key code when copying a set value.
	DIAG NG [error code] error messages	An error was detected in the self-check in the start-up. DIAG NG error messages 1) ROM: FlashRom program area check sum error 2) CHR: FlashRom character area check sum error 3) INFO: FlashRom information block check sum error 4) RAM: SDRAM data area 5) FRAM: FRAM data area check error 6) TCH: An error was detected in the touch panel. 7) RTC: An error was detected in the date and real time clock IC. 8) SD: An error was detected in the memory card, or the power was turned on before a memory card is inserted. 9) DAT: An error was detected in the data check of the setting value management. 10) MAC: The MAC address was not correct.
SYSTEM DOWN	**** ZERO DIVIDE ****	Error of division by zero (divided by zero).
	**** UNDEFINED INSTRUCTION ****	An undefined instruction was given.
	**** PREFETCH ABORT ****	An unauthorized instruction was fetched.
	**** DATA ABORT/WP ERROR ****	An unauthorized address was accessed.

Large Classification	Details	Error Description
SYSTEM DOWN	**** SYSTEM ERROR ****	A system error occurred (SYSTEM ERROR in the large classification occurred).
	**** WATCHDOG ERROR ****	An interruption by the watchdog timer occurred.
	**** UNKNOWN ERROR ****	A system shutdown occurred due to causes other than the above.
SYSTEM ERROR	pc_sd_io:Illegal buffer address.	Input-output buffer was in an odd address.
	pc_sd_io:Illegal drive number.	Drive number check error (a nonexistent drive number was designated).
	pc_sd_io:Illegal task priority.	An access of a task with a priority higher than the SD card transfer task occurred.
	MMExEntryEventBufferFail.	An event buffer registration failed.
	MMExEventBufferFull.	Overflow occurred in EventBuffer.
	InitialaizeNet:error at call to NU_Init_Net	Initialization of the nucleus net failed.
	File system initialaize error!	Initialization of the file system failed.
	ILLEGAL MAIN EXEC!	An illegal restart happened.
	Reached_raise().	A C language library runtime error occurred.
	Reached_sys_exit().	The main() function was exited, or a C language library runtime error occurred.
	OS resouces can not create!	Judged as a system error if all the resources cannot be properly created.
	HISR[%s] stack broken!	Overflow occurred in the HISR stack buffer.
	TASK[%s] stack broken!	Overflow occurred in the task stack buffer.
	FATAL OS ERROR!	A fatal error was detected in OS.
	ILLEGAL RESET!	An illegal reset interruption occurred while in operation.
	ILLEGAL INTERRUPT!	An illegal software interruption occurred.
	UNKNOWN FIQ!	An unknown high-speed interruption occurred.
	Wave buffer initialize error!	Wave buffer initialization failed.
	Root memory check error!	Fixed data or initialization data was broken.
	InitializeCheckResource() failure!	Resource check initialization failed.
	System stack broken!	An error was detected in the stack check.
	CheckResource() failure!	An error was detected in the resource check.
	Resouce[%s] overflow!	The resource usage ratio exceeded 95%.
	APSB_tBuffer over run!	The AP shared buffer exceeded its capacity.
	Buffer[%s] broken!	Fixed data or initialization data was broken.
	SYSCHK: VSync(LISR) NOP!	The VSYNC interruption was not activated.
	SYSCHK: Monitor Task NOP!	The monitor task was not activated.
	SYSCHK: WaveDrawTask NOP!	The wave drawing task was not activated.
	“SYSCHK: TimerTask NOP!	The timer manager was not activated.
	“SYSCHK: AlarmManager NOP!	The alarm manager was not activated.
	SYSCHK: NumericDrawTask NOP!	The numeric character drawing task was not activated.
	SYSCHK: RootTask NOP!	The root task was not activated.
	SYSCHK: Scheduler(HISR) NOP!	HISR did not operate during the VSYNC interruption.
	TIMER: RTC STOP?	Date and time indication was not updated for three seconds or over.
	TIMER: GetPresentTime() fail.	Acquisition of the current date and time from the date and real time clock IC failed.
	Exception repeated many times!	Exception handlings occurred repeatedly.
	Interrupt Error!	An interruption did not occur.

Section 3 Diagnostic Check and Safety Check

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Appearance Check

Checking the Appearance for Damage and Dirt

Check the following items.

- All parts of the monitor are free of dirt.
- The exterior of the monitor is free of breakage, including cracks.
- The labels are not come off or torn off.
- The connectors and switches are not cracked or loose.
- No parts are soiled with blood or chemicals.

Checking the Power Cord

Use only the power cord specified by Nihon Kohden. Visually check that it is free of dirt, breakage or torn coating. Additionally, use a circuit tester to check that the power cord's grounding conductor is not broken.

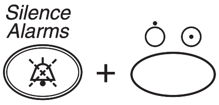
Displaying the DIAGNOSTIC CHECK Screen

Use this screen to display the error history or perform manual check or system setup and initialization.

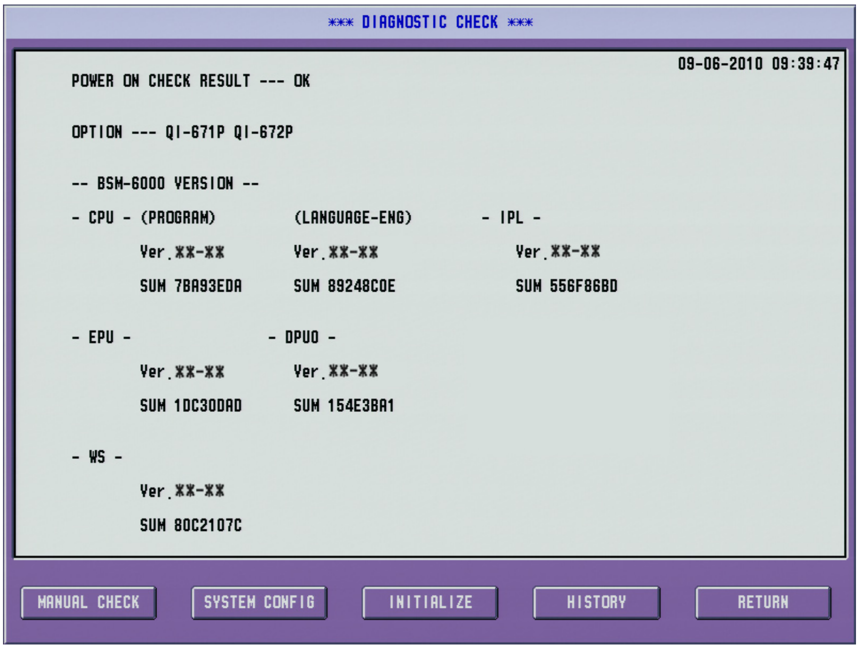
CAUTION

This procedure interrupts all monitoring. Only change these settings before or after monitoring.

1. Turn the monitor power off.



2. Press the [Power] switch while pressing the [Silence Alarms] key on the front panel until the DIAGNOSTIC CHECK screen is displayed.

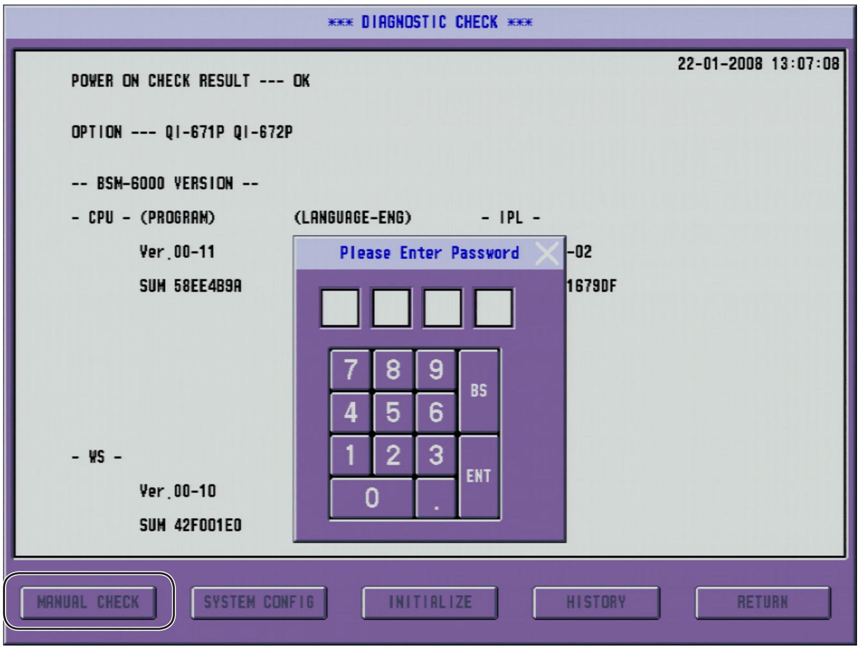


```
                                                        09-06-2010 09:39:47
POWER ON CHECK RESULT --- OK

OPTION --- QI-671P QI-672P

-- BSM-6000 VERSION --
- CPU - (PROGRAM)        (LANGUAGE-ENG)        - IPL -
        Ver.XX-XX        Ver.XX-XX                Ver.XX-XX
        SUM 7BA93EDA     SUM 89248C0E             SUM 556F86BD

- EPU -               - DPU0 -
        Ver.XX-XX        Ver.XX-XX
        SUM 1DC30DAD     SUM 154E3BA1

- WS -
        Ver.XX-XX
        SUM 80C2107C
```

3. To exit the DIAGNOSTIC CHECK screen and return to the home screen, touch the RETURN key.

Displaying the MANUAL CHECK Screen

1. Touch the MANUAL CHECK key. The window to enter the password appears.

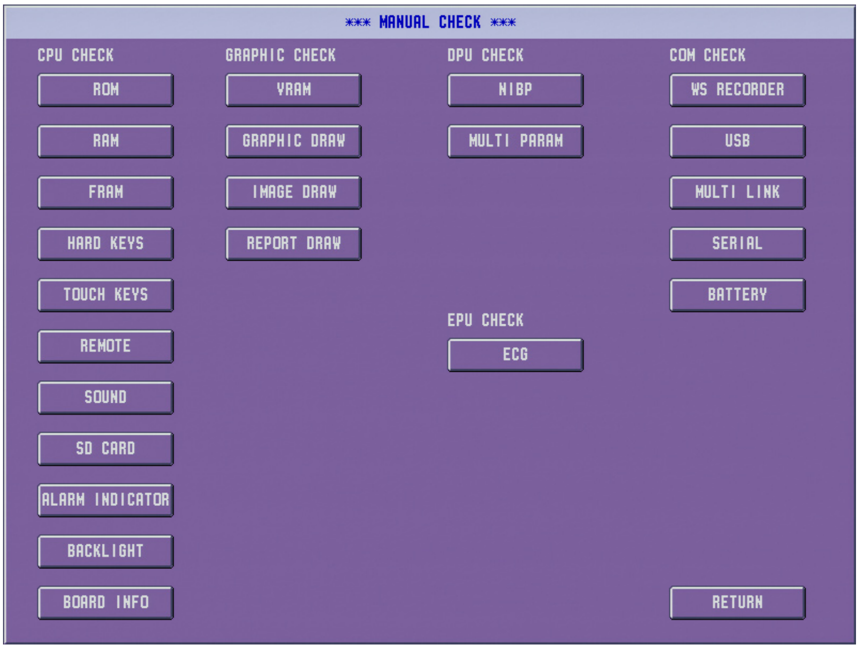


```
*** DIAGNOSTIC CHECK ***
                                                  22-01-2008 13:07:08
POWER ON CHECK RESULT --- OK

OPTION --- QI-671P QI-672P

-- BSM-6000 VERSION --
- CPU - (PROGRAM)          (LANGUAGE-ENG)        - IPL -
        Ver.00-11                                -02
        SUM 58EE4B9A                             1679DF

- WS -
        Ver.00-10
        SUM 42F001E0
```

Please Enter Password
7
8
9
BS
4
5
6
1
2
3
ENT
0
.
MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

2. Enter the password with the number keys and touch the ENT key. The MANUAL CHECK screen appears.

   The default password is “1234”.

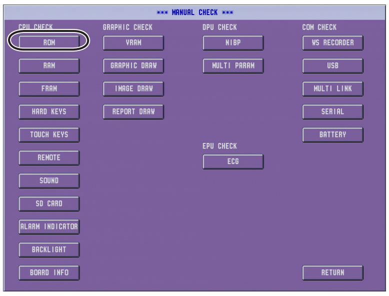


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

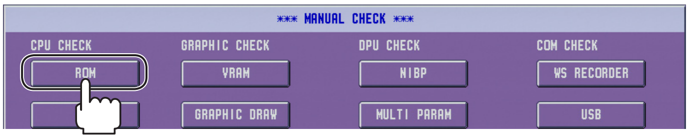
3. To exit the MANUAL CHECK screen and return to the DIAGNOSTIC CHECK screen, touch the RETURN key.

Checking the ROM

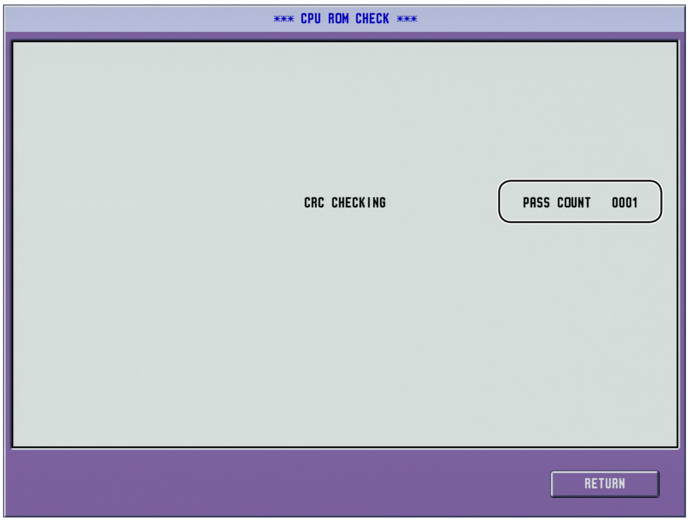
Check the ROM within the monitor to see if the main board is not defective.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

1. On the MANUAL CHECK screen, touch the ROM key to display the CPU ROM CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB

2. The ROM is checked automatically. On the CPU ROM CHECK screen, check that the PASS COUNT value increments from 00000 in steps of 1. This takes about 10 to 15 seconds. Make sure that no error indication appears.

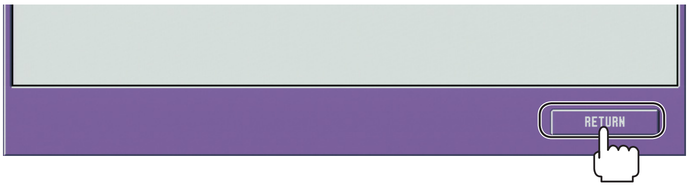

*** CPU ROM CHECK ***
RETURN

CRC CHECKING

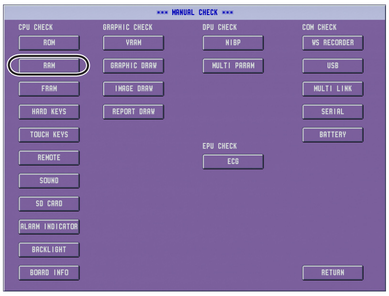
PASS COUNT 0001

When there is no error indication and the count is increased from 00000 to 00001, it is the end of the check.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

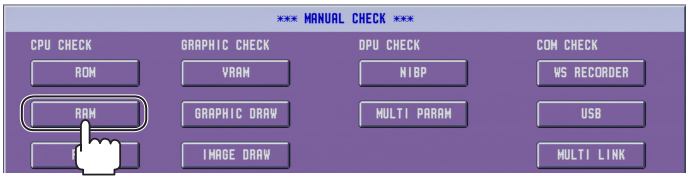


Checking the RAM

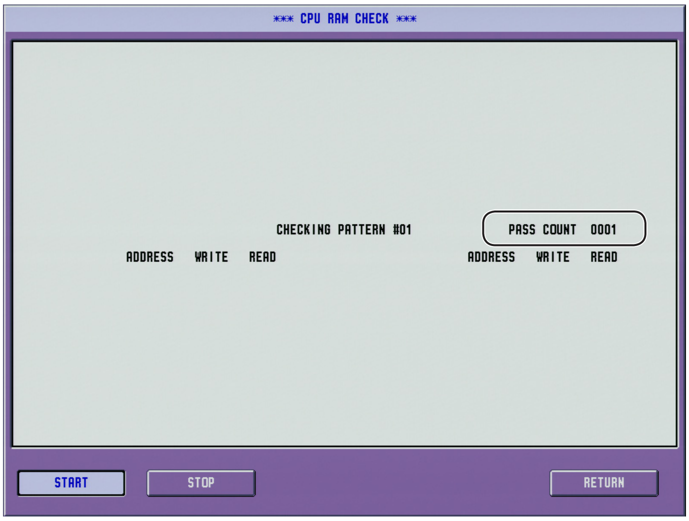

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

Check the ROM within the monitor to see if the main board is not defective.

1. On the MANUAL CHECK screen, touch the RAM key to display the CPU RAM CHECK screen.

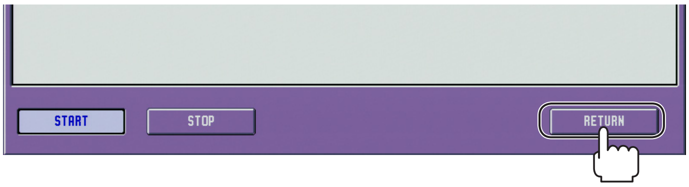

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB
MULTI LINK

2. The RAM is checked automatically. On the CPU RAM CHECK screen, check that the PASS COUNT value increments from 00000 in steps of 1. This takes about 30 seconds. Make sure that no error indication appears.

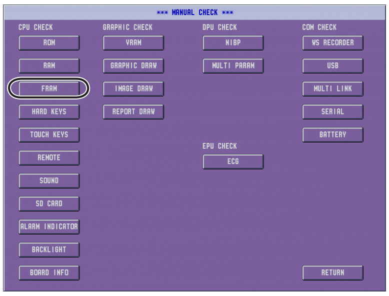

*** CPU RAM CHECK ***
CHECKING PATTERN #01
PASS COUNT 0001
ADDRESS WRITE READ
ADDRESS WRITE READ
START
STOP
RETURN

When there is no error indication and the count is increased from 00000 to 00001, it is the end of the check.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

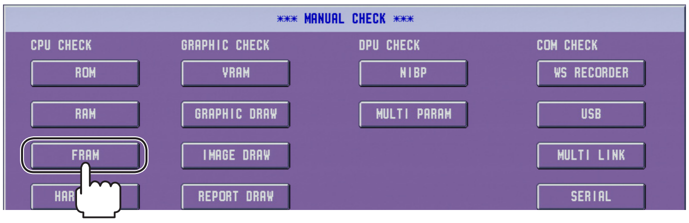

START
STOP
RETURN

Checking the FRAM

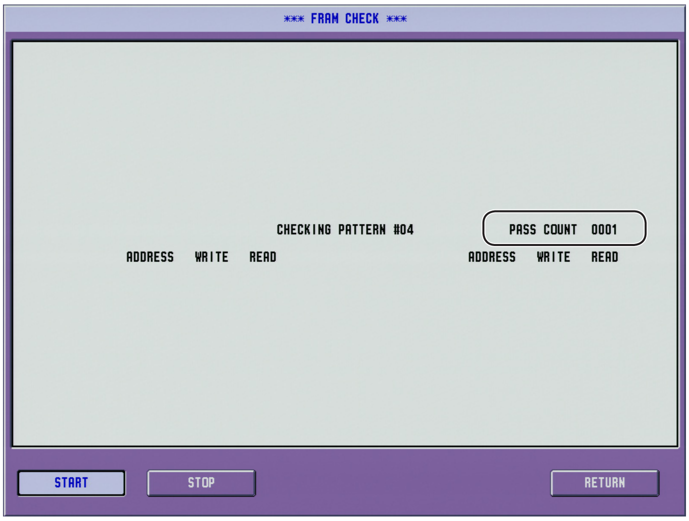

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

Check the FRAM within the monitor to see if the main board is not defective.

1. On the MANUAL CHECK screen, touch the FRAM key to display the FRAM CHECK screen.

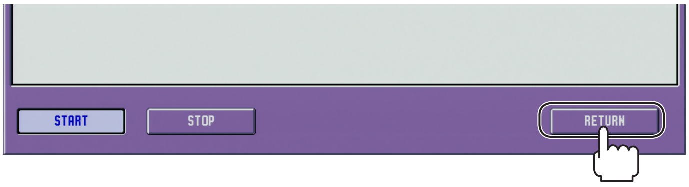

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HAR
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL

2. The FRAM is checked automatically. On the FRAM CHECK screen, check that the PASS COUNT value increments from 0000 in steps of 1. Make sure that no error indication appears.


*** FRAM CHECK ***
CHECKING PATTERN #04
PASS COUNT 0001
ADDRESS WRITE READ
ADDRESS WRITE READ
START
STOP
RETURN

When there is no error indication and the count is increased from 0000 to 0001, it is the end of the check.

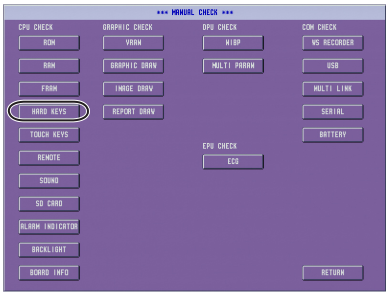
3. Touch the RETURN key to return to the MANUAL CHECK screen.


START
STOP
RETURN

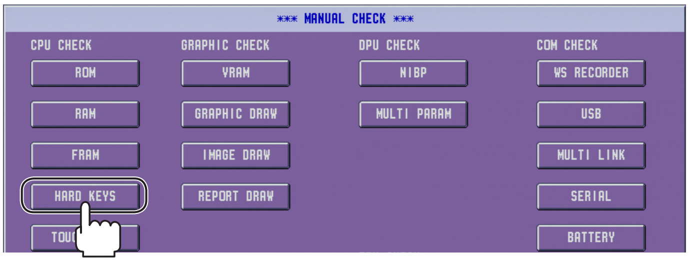
Checking Key Operation

Check if the following keys on the front of the main unit are free of internal failure, such as poor contact.

- [Silence Alarms] key
- [NIBP Start/Stop] key
- [Menu] key
- [Home] key
- [Record/Stop] key (option)

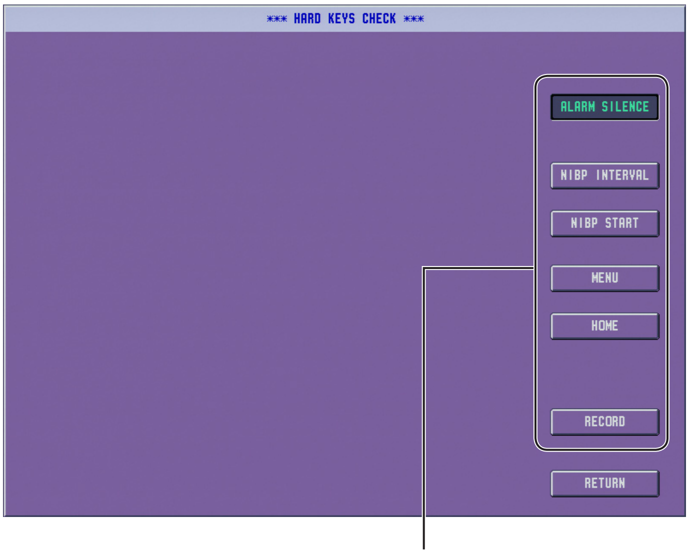

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

1. On the MANUAL CHECK screen, touch the HARD KEYS key to display the HARD KEYS CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOU
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY

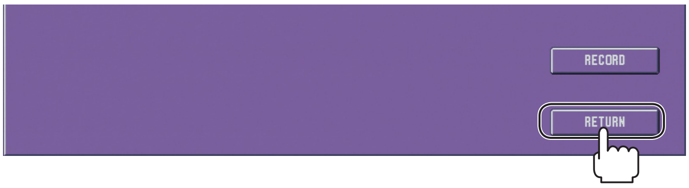
2. Press each key and check that the image corresponding to the pressed key is highlighted.

<Example: When the Silence Alarms key is pressed>


*** HARD KEYS CHECK ***
ALARM SILENCE
NIBP INTERVAL
NIBP START
MENU
HOME
RECORD
RETURN

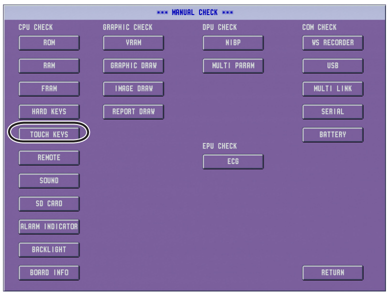
Check that the image corresponding to the pressed key is highlighted.
ALARM SILENCE: [Silence Alarms] key
NIBP INTERVAL: [NIBP interval] key
NIBP START: [NIBP Start/Stop] key
MENU: [Menu] key
HOME: [Home] key
RECORD: [Record/Stop] key (option)

3. Touch the RETURN key to return to the MANUAL CHECK screen.

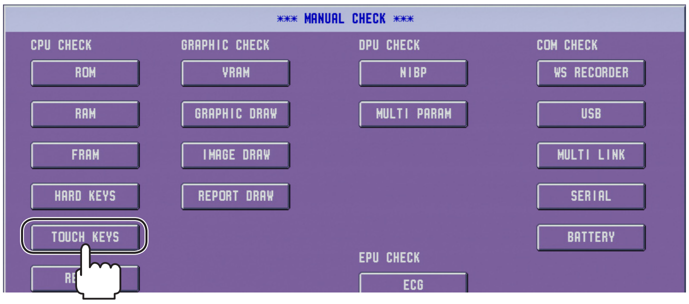

RECORD
RETURN

Checking the Operation of Touch Keys

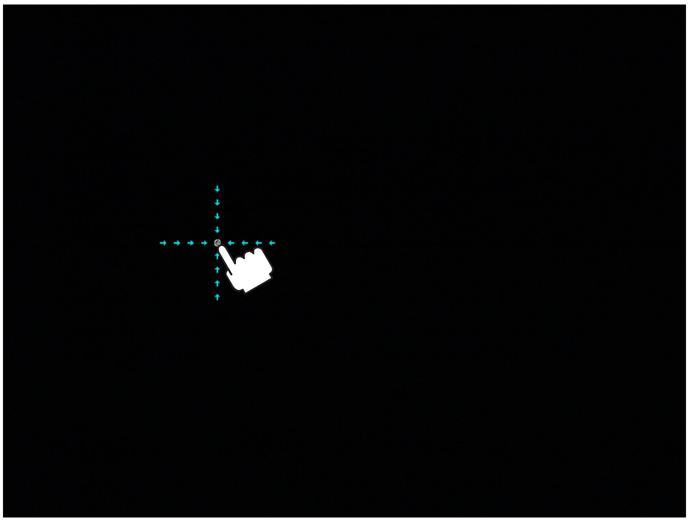
Check that the touch key position is correct.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

1. On the MANUAL CHECK screen, touch the TOUCH KEYS key to display the confirmation screen for touch keys.

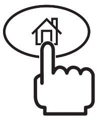

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY

2. Touch somewhere on the screen and check that the "@" confirmation mark moves to the touched position.



If the touched position does not match the "@" confirmation mark, perform the procedure explained in "Calibrating the Touch Panel" on the next page.

Home

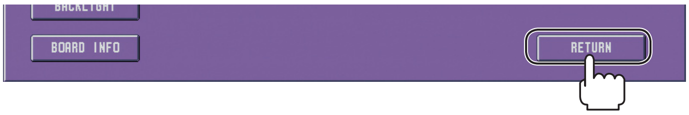


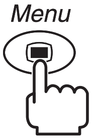
3. Press the [Home] key to return to the MANUAL CHECK screen.

Calibrating the Touch Panel

You can calibrate the touch panel, as required. If the actual working position is different from the touched position, correct the working position.

1. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.





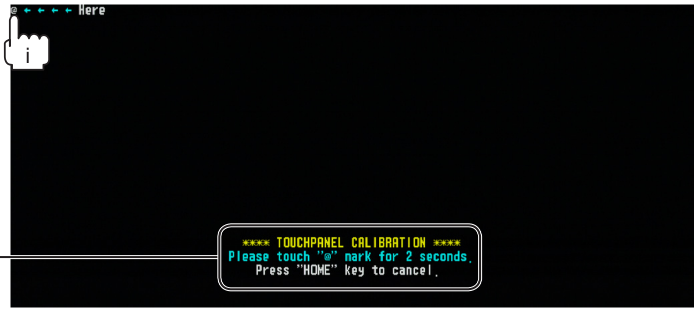
2. With the DIAGNOSTIC CHECK screen displayed, press the [Menu] key to display the calibration screen for the touch panel.

3. Calibrate the touch panel.

NOTE

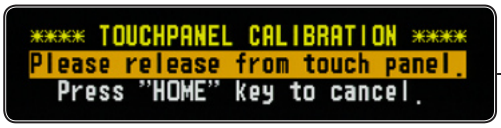
If you stop calibration halfway (by pressing the [Home] key or turning off power), the result is that the detection position in the touch panel shows a shift. If this occurs, perform the calibration again.

i) Touch the "@" calibration key, which appears at the top left of the screen, keep it pressed for at least 2 seconds and release your finger when the "Please release from touch panel." message appears.



**** TOUCHPANEL CALIBRATION ****
Please touch "@" mark for 2 seconds.
Press "HOME" key to cancel.

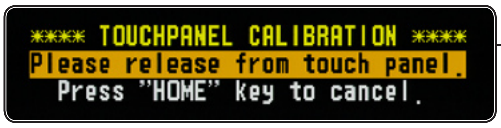
Release your finger when the following message appears.



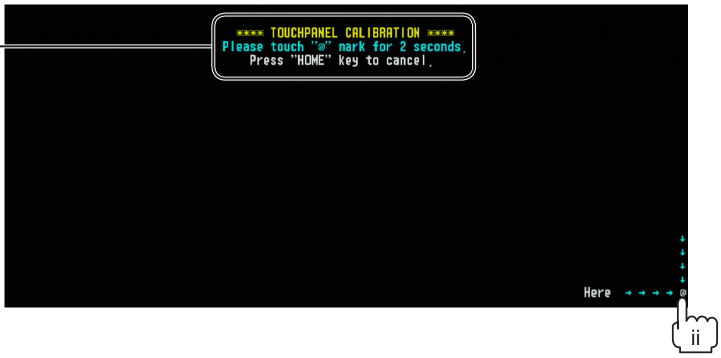
**** TOUCHPANEL CALIBRATION ****
Please release from touch panel.
Press "HOME" key to cancel.

ii) Touch the "@" calibration key, which appears at the bottom right of the screen, keep it pressed for at least 2 seconds and release your finger when the "Please release from touch panel." message appears.

Release your finger when the following message appears.

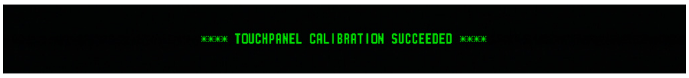


**** TOUCHPANEL CALIBRATION ****
Please release from touch panel.
Press "HOME" key to cancel.



**** TOUCHPANEL CALIBRATION ****
Please touch "@" mark for 2 seconds.
Press "HOME" key to cancel.

iii) Check that the “TOUCHPANEL CALIBRATION SUCCEEDED” message appears to show that calibration is completed.

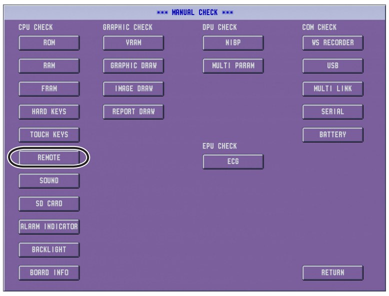


**** TOUCHPANEL CALIBRATION SUCCEEDED ****

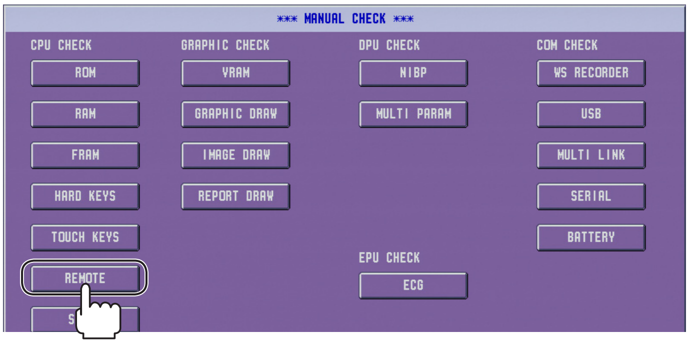
4. Press the [Home] key to return to the DIAGNOSTIC CHECK screen.

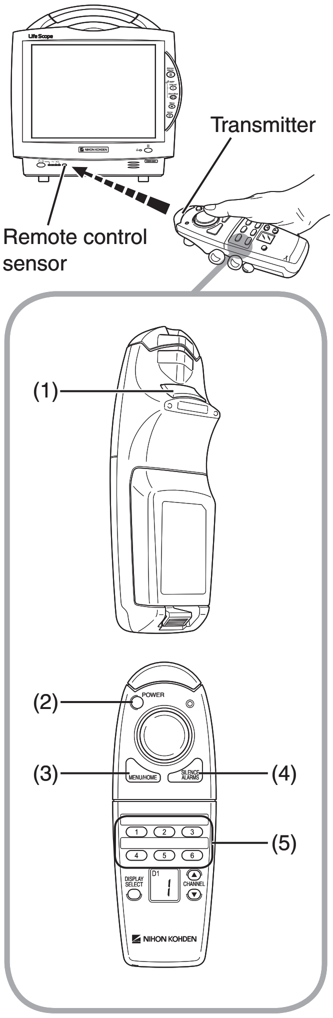
Checking the RY-910PA Remote Controller (Option)

As an optional item, the RY-910PA remote controller is available. Check that all keys on the remote controller are not defective.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

1. On the MANUAL CHECK screen, touch the REMOTE key to display the REMOTE CHECK screen.

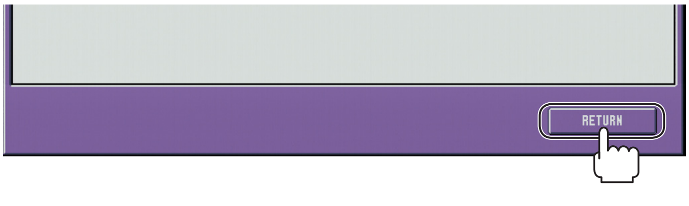

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY


Transmitter
Remote control sensor
(1)
(2)
(3)
(4)
(5)
POWER
MENU/HOME
SILENCE ALARMS
DISPLAY SELECT
CHANNEL
NIHON KOHDEN

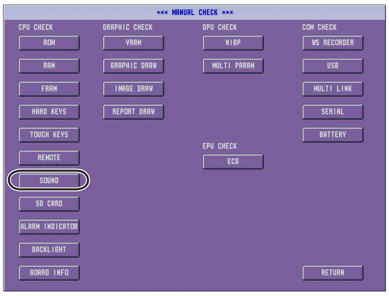
2. Check that all keys on the remote controller are not defective.
   i) Face the transmitter of the remote controller to the remote control sensor on the front of the monitor and press individual operation keys.
   ii) On the REMOTE CHECK screen, check that you see the code number corresponding to the pressed operation key.

Operation Key on the Remote Controller			Corresponding Code Number
(1)	ENTER key		82 XX XX 00 XX
(2)	POWER button		80 XX XX 02 XX
(3)	MENU/HOME key		80 XX XX 03 XX
(4)	SILENCE ALARMS key		80 XX XX 04 XX
(5)	Customize key	1	80 XX XX 63 XX
		2	80 XX XX 65 XX
		3	80 XX XX 67 XX
		4	80 XX XX 69 XX
		5	80 XX XX 6B XX
		6	80 XX XX 6D XX

3. Touch the RETURN key to return to the MANUAL CHECK screen.

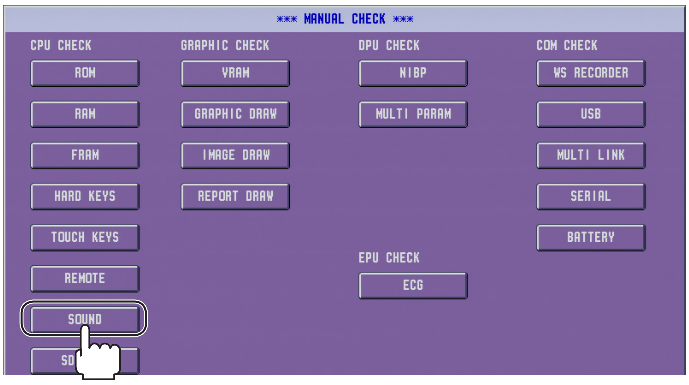


Checking the Sound Output

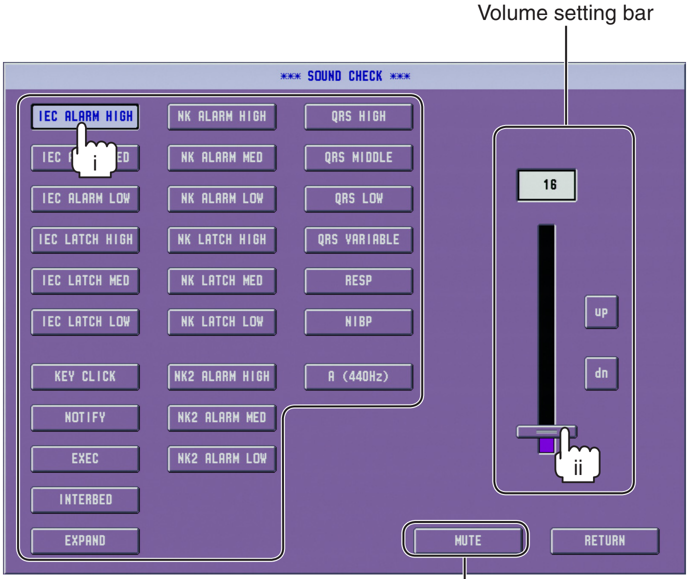

*** MANUAL CHECK ***
SOUND

Generate the alarm sound, synchronous sound and key sound to check the states of the sound source and the amplifier. Additionally, check the sound volume.

1. On the MANUAL CHECK screen, touch the SOUND key to display the SOUND CHECK screen.

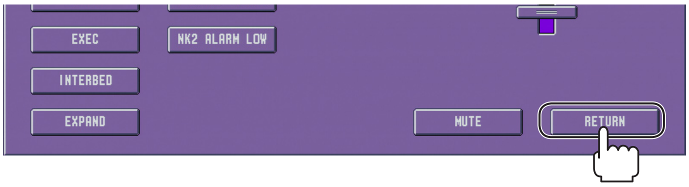

*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY

2. Check the sound output.
   i) Select the type of a sound to be checked.
   ii) Check that the selected sound is changed in volume when you slide the volume setting bar vertically or touch the up and dn keys.


Volume setting bar
*** SOUND CHECK ***
IEC ALARM HIGH
IEC ALARM MED
IEC ALARM LOW
IEC LATCH HIGH
IEC LATCH MED
IEC LATCH LOW
KEY CLICK
NOTIFY
EXEC
INTERBED
EXPAND
NK ALARM HIGH
NK ALARM MED
NK ALARM LOW
NK LATCH HIGH
NK LATCH MED
NK LATCH LOW
NK2 ALARM HIGH
NK2 ALARM MED
NK2 ALARM LOW
QRS HIGH
QRS MIDDLE
QRS LOW
QRS VARIABLE
RESP
NIBP
A (440Hz)
16
up
dn
i
ii
MUTE
RETURN

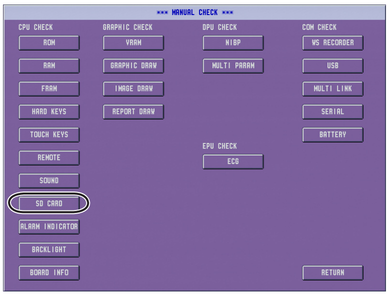
MUTE
Touch the MUTE key to cut the sound for a while.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

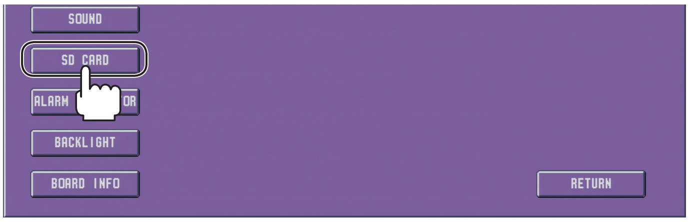

EXEC
NK2 ALARM LOW
INTERBED
EXPAND
MUTE
RETURN

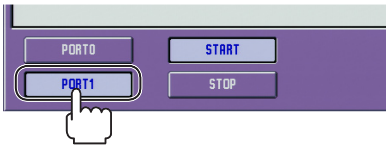
Checking the Memory Card

Check that the internal memory card works normally.

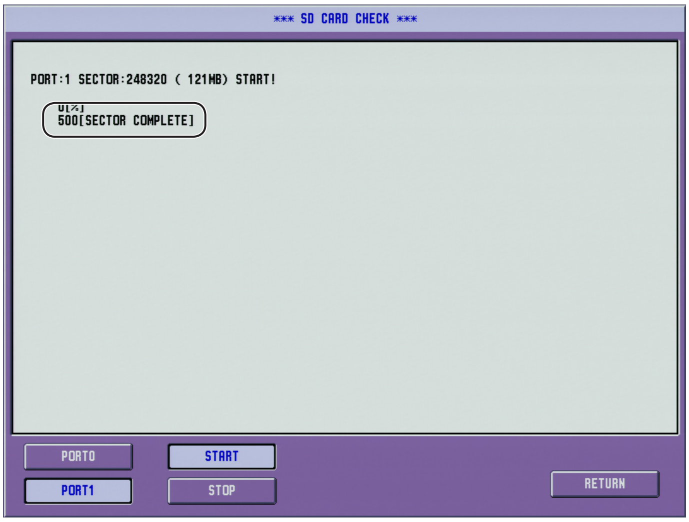

*** MANUAL CHECK ***
CPU CHECK
GRAPHIC CHECK
DPU CHECK
COM CHECK
ROM
VRAM
NIBP
WS RECORDER
RAM
GRAPHIC DRAW
MULTI PARAM
USB
FRAM
IMAGE DRAW
MULTI LINK
HARD KEYS
REPORT DRAW
SERIAL
TOUCH KEYS
BATTERY
EPU CHECK
ECG
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
RETURN

1. On the MANUAL CHECK screen, touch the SD CARD key to display the SD CARD CHECK screen.


SOUND
SD CARD
ALARM
OR
BACKLIGHT
BOARD INFO
RETURN


PORT0
START
PORT1
STOP

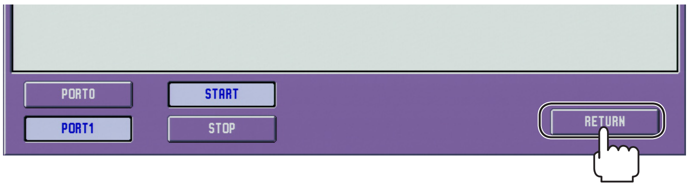
2. Touch the PORT1 key to start checking the internal memory card. Observe the screen for approximately one minute to check that the SECTOR COMPLETE value increments from 0 in steps of 1 and that there is no error indication.


*** SD CARD CHECK ***
PORT0
START
PORT1
STOP
RETURN

```
PORT:1 SECTOR:248320 ( 121MB) START!
0[%]
500[SECTOR COMPLETE]
```

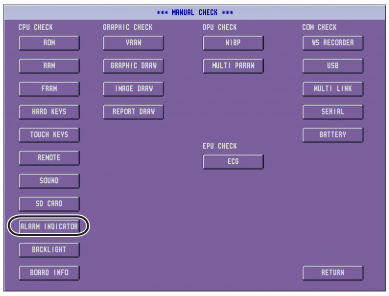
The check is completed if there is no error indication and the SECTOR COMPLETE value increments from 0 in steps of 1.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

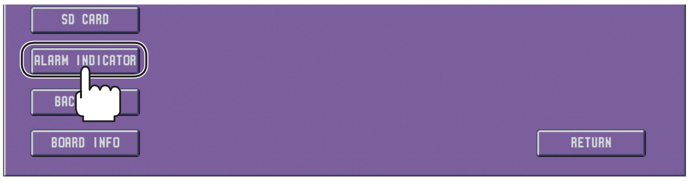

PORT0
START
PORT1
STOP
RETURN

Checking the Alarm Indicator

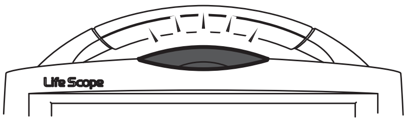
Check that there is nothing wrong with the optical transmitter of the alarm indicator.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

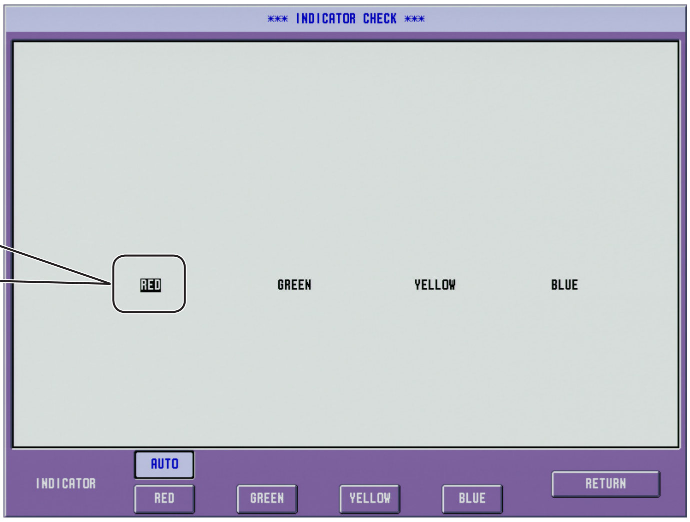
1. On the MANUAL CHECK screen, touch the ALARM INDICATOR key to display the INDICATOR CHECK screen.


SD CARD
ALARM INDICATOR
BAC
BOARD INFO
RETURN

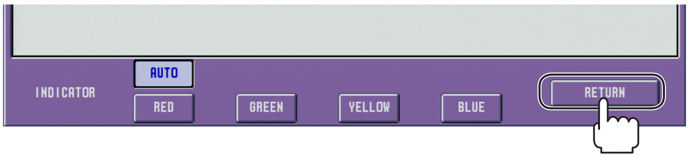
2. The RED, GREEN, YELLOW and BLUE indicators shown on the screen are highlighted in order. You can also check the alarm indicator by touching RED, GREEN, YELLOW and BLUE key at the bottom of the screen. Check that the highlighted color illuminates the indicator.



Check that the alarm indicator lights in red (RED). Check that the other highlighted colors light up in turn: in green (GREEN), yellow (YELLOW) and blue (BLUE).

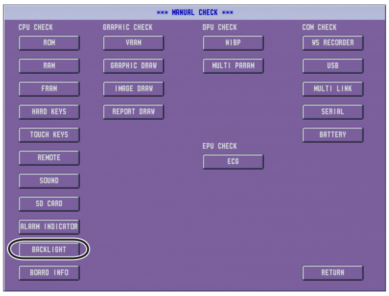

*** INDICATOR CHECK ***
RED
GREEN
YELLOW
BLUE
INDICATOR
AUTO
RED
GREEN
YELLOW
BLUE
RETURN

3. Touch the RETURN key to return to the MANUAL CHECK screen.

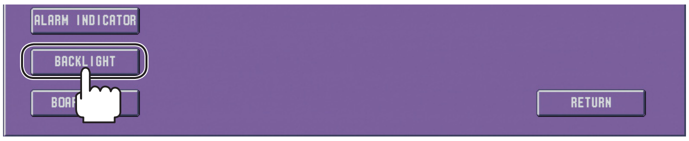

INDICATOR
AUTO
RED
GREEN
YELLOW
BLUE
RETURN

Checking the Backlighting

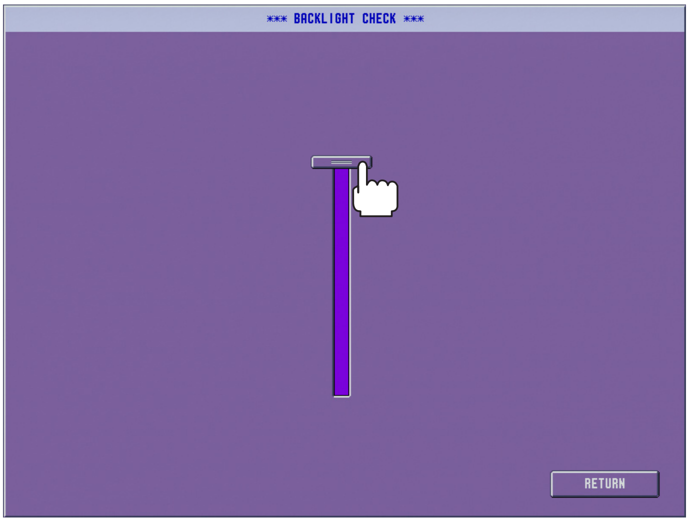
Check the display’s brightness adjustment function.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

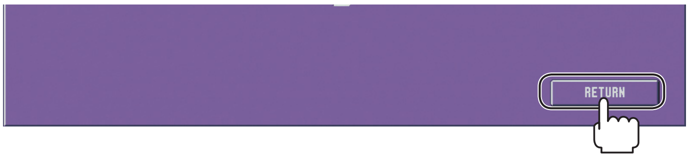
1. On the MANUAL CHECK screen, touch the BACKLIGHT key to display the BACKLIGHT CHECK screen.


ALARM INDICATOR
BACKLIGHT
BOAR
RETURN

2. Check that the screen brightness changes by sliding the brightness adjustment bar vertically.

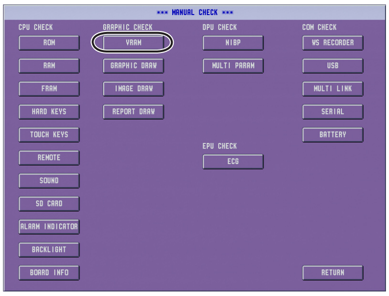

*** BACKLIGHT CHECK ***
RETURN

3. Touch the RETURN key to return to the MANUAL CHECK screen.

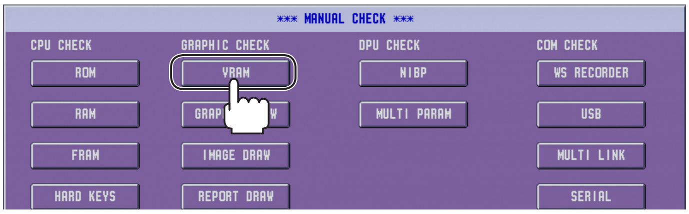


Checking the VRAM

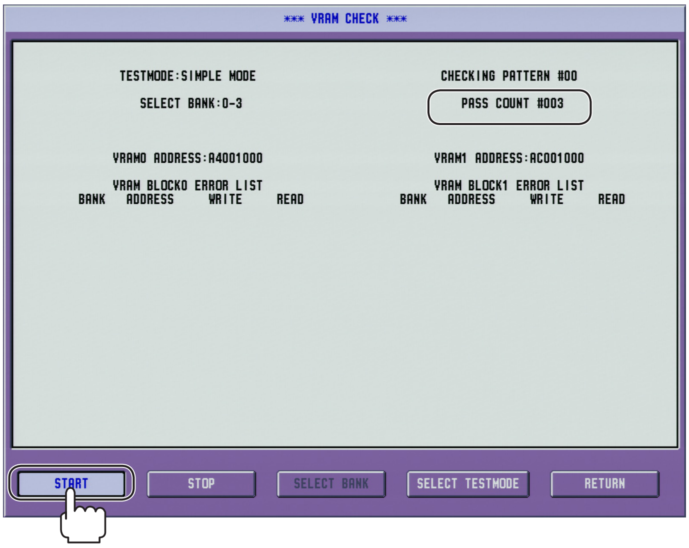
Check the VRAM within the monitor to see if the main board is not defective.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

1. On the MANUAL CHECK screen, touch the VRAM key to display the VRAM CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
GRAPHIC CHECK
VRAM
GRAP W
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL

2. Touch the START key to check the VRAM (SIMPLE MODE).
   Observe the screen for approximately one minute to check that the PASS COUNT value increments from #000 in steps of 1 and that there is no error indication.

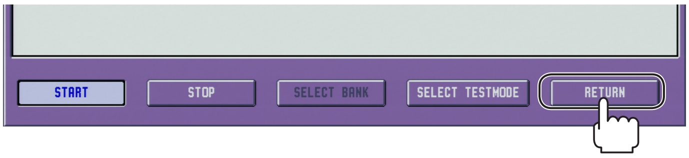

*** VRAM CHECK ***

```
TESTMODE:SIMPLE MODE                      CHECKING PATTERN #00
SELECT BANK:0-3                           PASS COUNT #003

VRAM0 ADDRESS:A4001000                    VRAM1 ADDRESS:AC001000
       VRAM BLOCK0 ERROR LIST                    VRAM BLOCK1 ERROR LIST
BANK  ADDRESS     WRITE     READ          BANK  ADDRESS     WRITE     READ
```

START
STOP
SELECT BANK
SELECT TESTMODE
RETURN

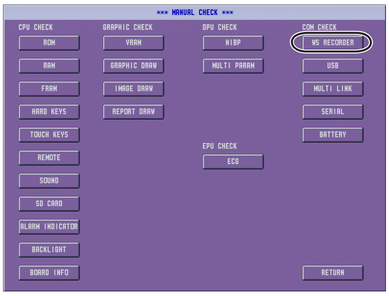
The check is completed if there is no error indication and the PASS COUNT value increments from #000 in steps of 1.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

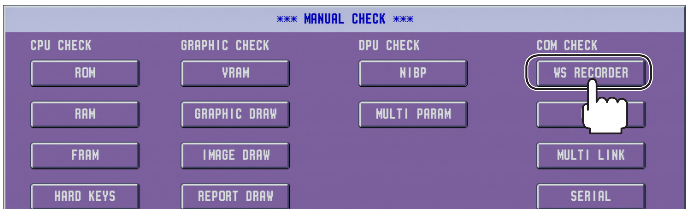

START
STOP
SELECT BANK
SELECT TESTMODE
RETURN

Checking the WS-671P Recorder Module (Option)

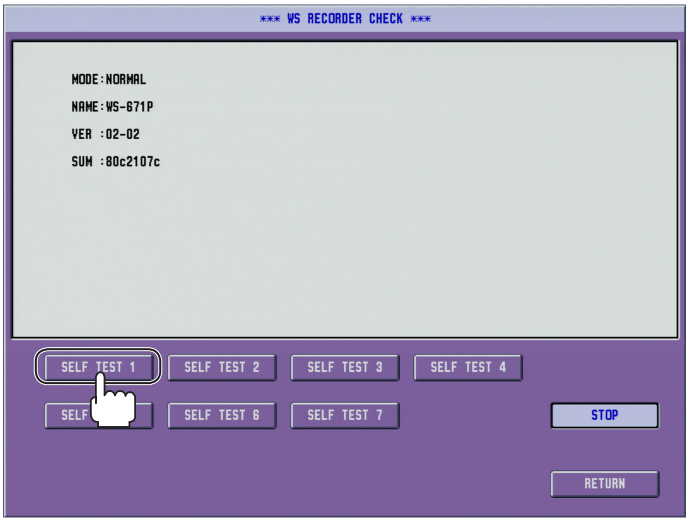
Check that the optional WS-671P recorder module is free from poor operation.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN

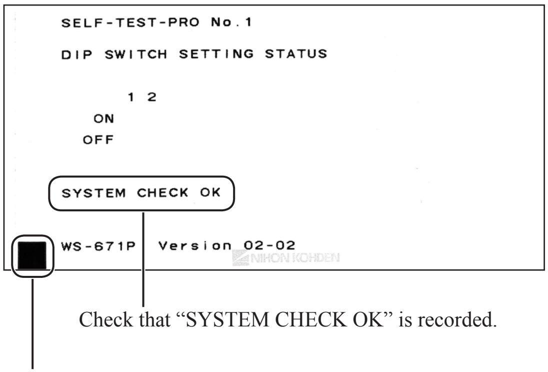
1. On the MANUAL CHECK screen, touch the WS RECORDER key to display the RECORDER CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
MULTI LINK
SERIAL

2. Touch the SELF TEST 1 key to perform test recording and check that “SYSTEM CHECK OK” is recorded on the recording paper.


*** WS RECORDER CHECK ***
SELF TEST 1
SELF TEST 2
SELF TEST 3
SELF TEST 4
SELF
SELF TEST 6
SELF TEST 7
STOP
RETURN

```
MODE:NORMAL
NAME:WS-671P
VER :02-02
SUM :80c2107c
```



```
SELF-TEST-PRO No.1
DIP SWITCH SETTING STATUS

      1 2
  ON
 OFF

SYSTEM CHECK OK

WS-671P   Version 02-02
```

Check that “SYSTEM CHECK OK” is recorded.

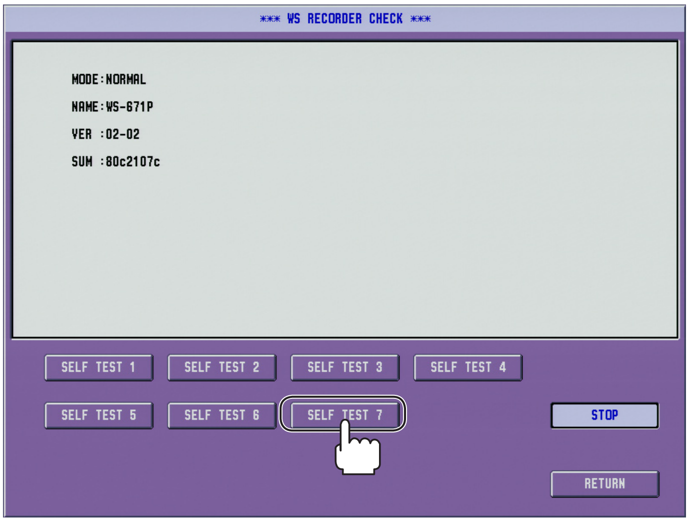
Mark
Check that recording paper is fed to the marked position before recording is started.

If you are running out of recording paper or if the magazine is left open, the following messages appear.

- Running out of recording paper: PAPER EMPTY
- The magazine is left open: MAGAZINE OPEN

3. Touch the SELF TEST 7 key to perform test recording, and touch the STOP key when at least one page has been recorded. Check that recording paper shows no blurred printing, missing dots or non-uniform density.

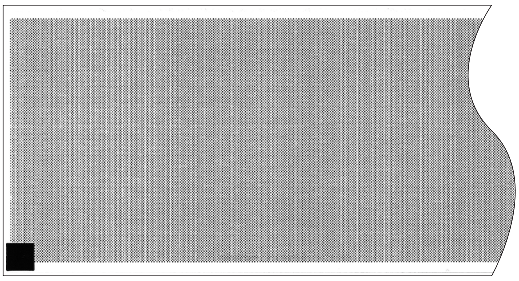
   If there are blurred printing, missing dots or non-uniform density, clean the thermal head of recorder module.



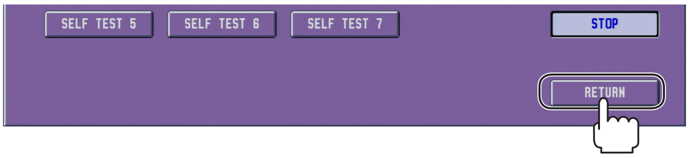
*** WS RECORDER CHECK ***

MODE:NORMAL
NAME:WS-671P
VER :02-02
SUM :80c2107c

SELF TEST 1
SELF TEST 2
SELF TEST 3
SELF TEST 4
SELF TEST 5
SELF TEST 6
SELF TEST 7
STOP
RETURN



4. Touch the RETURN key to return to the MANUAL CHECK screen.

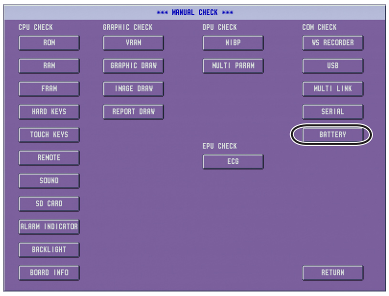


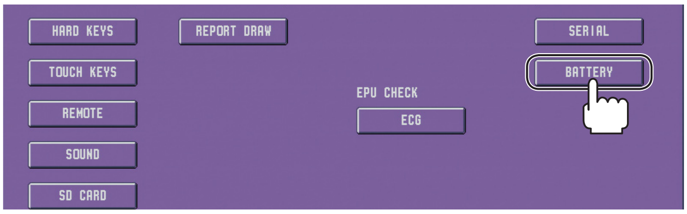
SELF TEST 5
SELF TEST 6
SELF TEST 7
STOP
RETURN

Checking the Battery (Option)

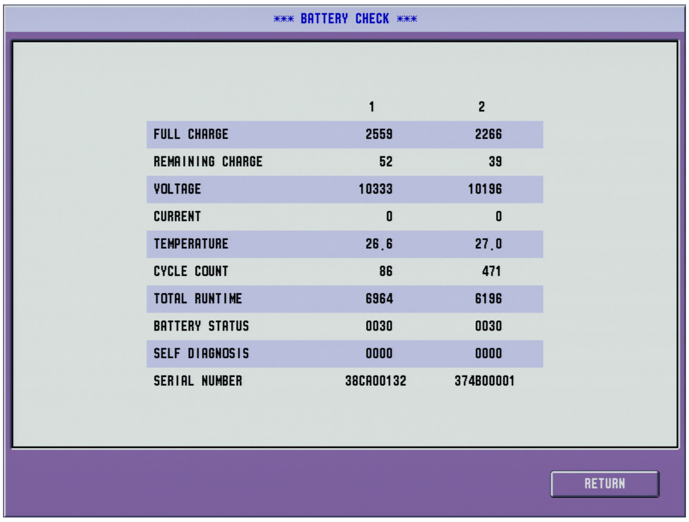
Check the optional SB-671P battery pack.

1. On the MANUAL CHECK screen, touch the BATTERY key to display the BATTERY CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
ALARM INDICATOR
BACKLIGHT
BOARD INFO
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
EPU CHECK
ECG
COM CHECK
WS RECORDER
USB
MULTI LINK
SERIAL
BATTERY
RETURN


HARD KEYS
TOUCH KEYS
REMOTE
SOUND
SD CARD
REPORT DRAW
EPU CHECK
ECG
SERIAL
BATTERY

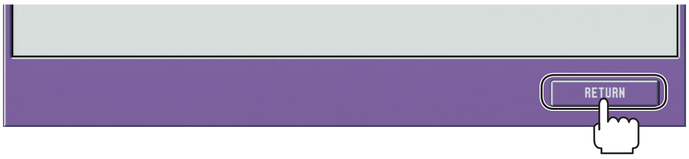
2. Check the battery information on the screen.


*** BATTERY CHECK ***
RETURN

	1	2
FULL CHARGE	2559	2266
REMAINING CHARGE	52	39
VOLTAGE	10333	10196
CURRENT	0	0
TEMPERATURE	26.6	27.0
CYCLE COUNT	86	471
TOTAL RUNTIME	6964	6196
BATTERY STATUS	0030	0030
SELF DIAGNOSIS	0000	0000
SERIAL NUMBER	38CA00132	374B00001

FULL CHARGE:	Charged battery capacity (mAh)
REMAINING CHARGE:	Percentage of the remaining battery capacity (%)
VOLTAGE:	Measured battery voltage (mV)
CURRENT:	Measured battery current (mA)
TEMPERATURE:	Measured battery temperature (°C)
CYCLE COUNT:	Number of discharges
TOTAL RUNTIME:	Accumulated runtime (h)
BATTERY STATUS:	Hexadecimal code of the battery status
SELF DIAGNOSIS:	Hexadecimal code of check result of the battery
SERIAL NUMBER:	Product serial number of the battery

3. Touch the RETURN key to return to the MANUAL CHECK screen.



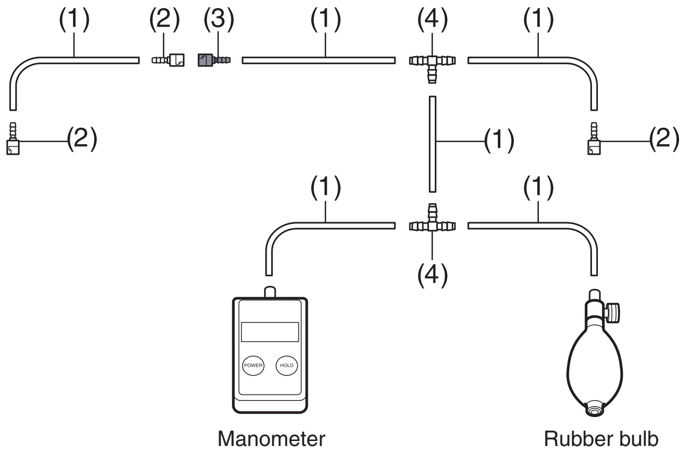
Checking the NIBP

Check the NIBP for measurement accuracy and other factors. This manual explains a method of verification with a manometer.

Preparations (Equipment Connection)

Before checking the NIBP, connect the following parts (1) to (4) to a manometer as shown below. In the following procedure, the term “manometer” refers to what is connected with the (1) to (4) parts.

Part Name Code		Number	Qty
(1)	Silicon tube 4 (diameter) L150	6114-110213	6
(2)	SMM-02 air joint (male)	531524	3
(3)	SMF-02 air joint (female)	538624	1
(4)	T-type coupling F-3145-85	551396	2



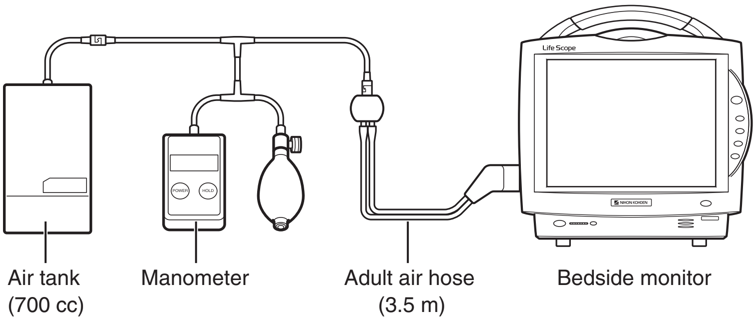
The following parts are used or changed depending on the check items. Prepare the parts before starting the check. The connection diagram and the direction for use are explained under each section.

Part Name	Type/Code Number	Qty
Adult/child air hose (3.5 m) YN-901P	S902	1
Neonate air hose (3.5 m) YN-921P	S905	1
Clamp	Purchase locally	1
Luer fitting (male) for neonate air hose	930272	1
Air tank 70 cc (dummy cuff)	626262	1
Air tank 250 cc (dummy cuff)	626289	1
Air tank 700 cc (dummy cuff)	626306	1

Checking the Pressure Measurement Accuracy (1. CALIBRATION)

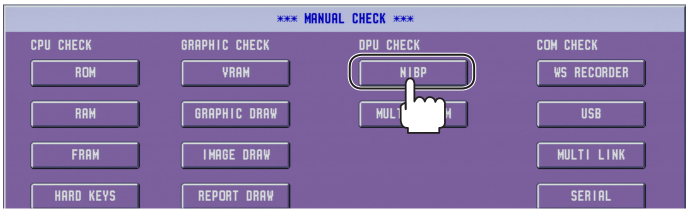
A manometer is used to check the pressure measurement accuracy.

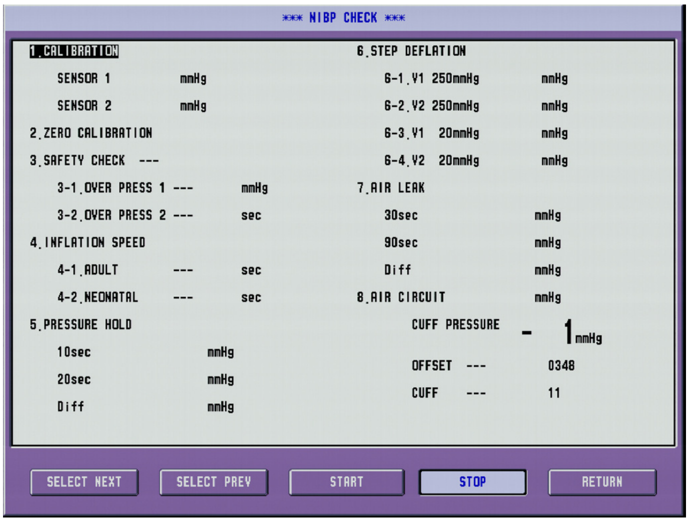
1. Connect the bedside monitor, adult air hose (3.5 m), a manometer, and a 700 cc air tank as shown below.


Air tank
(700 cc)
Manometer
Adult air hose
(3.5 m)
Bedside monitor
Life Scope
POWER
HOLD

2. Turn on the manometer.

3. On the MANUAL CHECK screen, touch the NIBP key to display the NIBP CHECK screen.

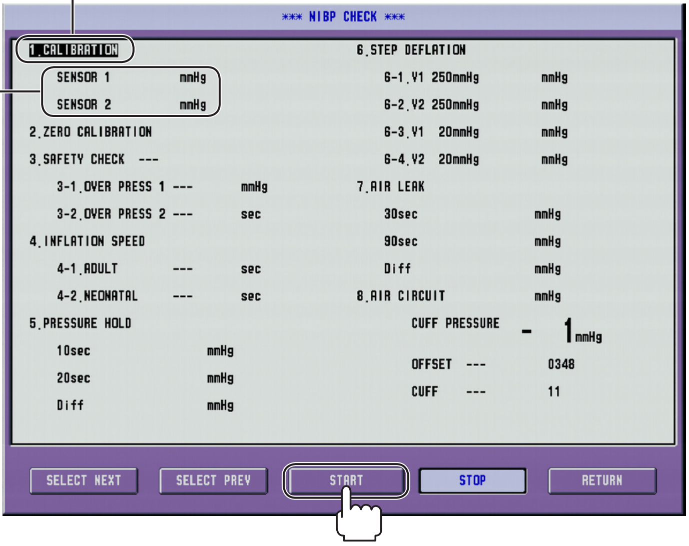

*** MANUAL CHECK ***
CPU CHECK
GRAPHIC CHECK
DPU CHECK
COM CHECK
ROM
VRAM
NIBP
WS RECORDER
RAM
GRAPHIC DRAW
MULTI
USB
FRAM
IMAGE DRAW
MULTI LINK
HARD KEYS
REPORT DRAW
SERIAL


*** NIBP CHECK ***
SELECT NEXT
SELECT PREV
START
STOP
RETURN

1.CALIBRATION
SENSOR 1 mmHg
SENSOR 2 mmHg
2.ZERO CALIBRATION
3.SAFETY CHECK ---
3-1.OVER PRESS 1 --- mmHg
3-2.OVER PRESS 2 --- sec
4.INFLATION SPEED
4-1.ADULT --- sec
4-2.NEONATAL --- sec
5.PRESSURE HOLD
10sec mmHg
20sec mmHg
Diff mmHg
6.STEP DEFLATION
6-1.V1 250mmHg mmHg
6-2.V2 250mmHg mmHg
6-3.V1 20mmHg mmHg
6-4.V2 20mmHg mmHg
7.AIR LEAK
30sec mmHg
90sec mmHg
Diff mmHg
8.AIR CIRCUIT mmHg
CUFF PRESSURE - 1 mmHg
OFFSET --- 0348
CUFF --- 11

4. Zero calibration is required before you start the check.
    - i) Touch the SELECT NEXT key to perform the procedure explained in the next “Zero Calibration (2. ZERO CALIBRATION)” section.
    - ii) When zero calibration is completed, touch the SELECT PREV key.

5. Run the check.
    - i) On the NIBP CHECK screen, check that <1. CALIBRATION> is highlighted and touch the START key.
      During the check, <1. CALIBRATION> blinks.
      Touching the STOP key stops the check.
    - ii) Using a rubber bulb, apply pressure until the value shown on the manometer reaches a value between 0 and 300 mmHg. Check that the value shown on the manometer and the values shown in the screen’s SENSOR 1 and SENSOR 2 meet the requirement of the tables below.



Check that <1. CALIBRATION> is highlighted.

Check the values shown in <SENSOR 1> and <SENSOR 2>.

```
                          *** NIBP CHECK ***
1.CALIBRATION                         6.STEP DEFLATION
    SENSOR 1          mmHg                6-1.V1 250mmHg       mmHg
    SENSOR 2          mmHg                6-2.V2 250mmHg       mmHg
2.ZERO CALIBRATION                        6-3.V1  20mmHg       mmHg
3.SAFETY CHECK  ---                       6-4.V2  20mmHg       mmHg
    3-1.OVER PRESS 1 ---    mmHg      7.AIR LEAK
    3-2.OVER PRESS 2 ---    sec           30sec               mmHg
4.INFLATION SPEED                         90sec               mmHg
    4-1.ADULT        ---    sec           Diff                mmHg
    4-2.NEONATAL     ---    sec       8.AIR CIRCUIT           mmHg
5.PRESSURE HOLD                               CUFF PRESSURE  -   1mmHg
    10sec                mmHg
    20sec                mmHg                 OFFSET  ---      0348
    Diff                 mmHg                 CUFF    ---      11
```

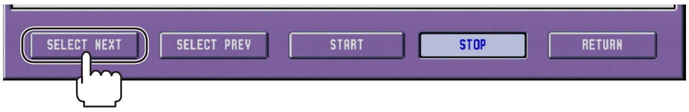
<SENSOR 1>

Indication of the Manometer (Pressurized Value)	**Indication of <SENSOR 1>**
0 to 199 mmHg	Value of the manometer ±3 mmHg (If the reading is 0 mmHg, then it is always at 0 mmHg.)
200 to 300 mmHg	Value of the manometer ±4 mmHg

<SENSOR 2>

Indication of the Manometer (Pressurized Value)	**Indication of <SENSOR 2>**
0 to 15 mmHg	Value of the manometer –2 to +3 mmHg (If the reading is 0 mmHg, then it is always at 0 mmHg.)
16 to 200 mmHg	Value of the manometer ±8 mmHg
201 to 300 mmHg	Value of the manometer ±12 mmHg

6. When the check is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Zero Calibration (2. ZERO CALIBRATION)” section.

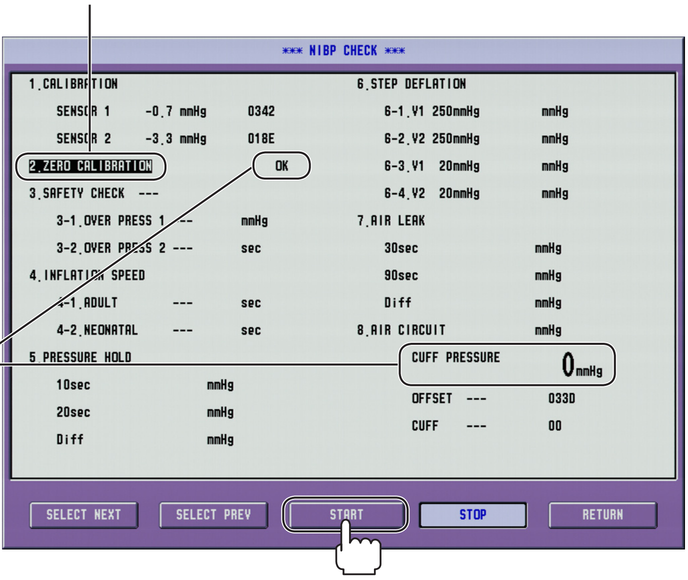


Zero Calibration (2. ZERO CALIBRATION)

1. On the NIBP CHECK screen, check that <2. ZERO CALIBRATION> is highlighted.

2. Run the zero calibration.
    - i) Check that the air tank is completely exhausted and touch the START key.
      During zero calibration, <2. ZERO CALIBRATION> blinks.
      Touching the STOP key stops the check.
    - ii) Check that the <CUFF PRESSURE> value reaches 0 and that the OK appears.

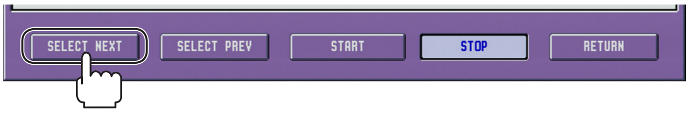
Check that <2. ZERO CALIBRATION> is highlighted.



```
*** NIBP CHECK ***
1.CALIBRATION                              6.STEP DEFLATION
   SENSOR 1   -0.7 mmHg    0342               6-1.V1 250mmHg        mmHg
   SENSOR 2   -3.3 mmHg    018E               6-2.V2 250mmHg        mmHg
2.ZERO CALIBRATION          OK                6-3.V1  20mmHg        mmHg
3.SAFETY CHECK ---                            6-4.V2  20mmHg        mmHg
   3-1.OVER PRESS 1 ---    mmHg            7.AIR LEAK
   3-2.OVER PRESS 2 ---    sec                30sec                mmHg
4.INFLATION SPEED                             90sec                mmHg
   4-1.ADULT        ---    sec                Diff                 mmHg
   4-2.NEONATAL     ---    sec             8.AIR CIRCUIT           mmHg
5.PRESSURE HOLD                               CUFF PRESSURE        0mmHg
   10sec                mmHg                  OFFSET  ---       033D
   20sec                mmHg                  CUFF    ---       00
   Diff                 mmHg
```

Check that the <CUFF PRESSURE> value reaches 0 and that the OK appears.

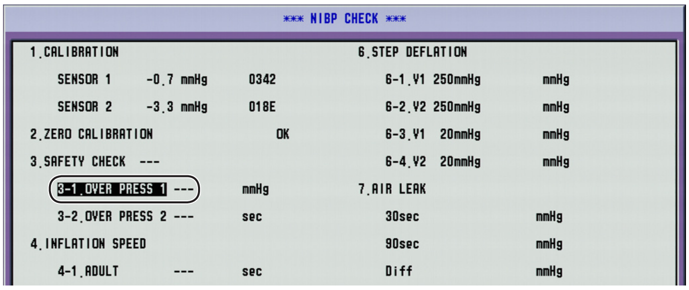
3. Touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Safety Circuit (3. SAFETY CHECK)” section.



Checking the Safety Circuit (3. SAFETY CHECK)

Using a manometer, check the operation of each safety circuit in adult/child mode and in neonatal mode.

1. On the NIBP CHECK screen, check that <3-1. OVER PRESS 1> is highlighted.



```
                              *** NIBP CHECK ***
1.CALIBRATION                                6.STEP DEFLATION
    SENSOR 1    -0.7 mmHg    0342                6-1.V1 250mmHg       mmHg
    SENSOR 2    -3.3 mmHg    018E                6-2.V2 250mmHg       mmHg
2.ZERO CALIBRATION                  OK           6-3.V1  20mmHg       mmHg
3.SAFETY CHECK  ---                              6-4.V2  20mmHg       mmHg
    3-1.OVER PRESS 1 ---          mmHg       7.AIR LEAK
    3-2.OVER PRESS 2 ---          sec            30sec                mmHg
4.INFLATION SPEED                                90sec                mmHg
    4-1.ADULT        ---          sec            Diff                 mmHg
```

2. Run the check in adult/child mode.

   Checking in Adult/Child Mode

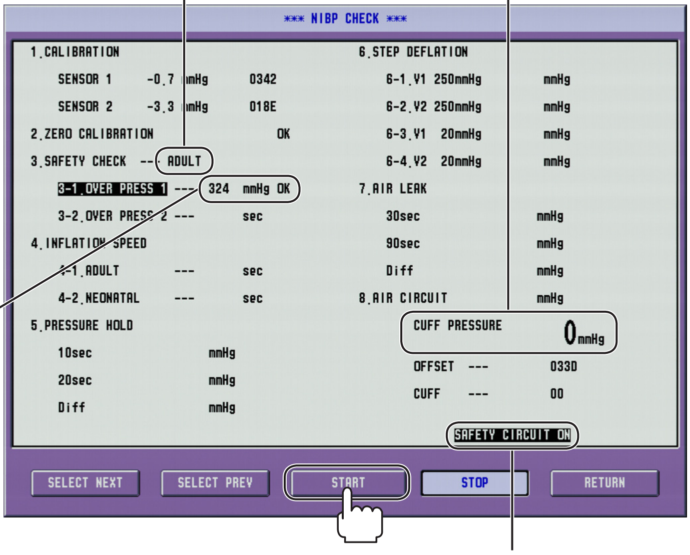
   i) Touch the START key to start the check procedure in <3-1. OVER PRESS 1>. ADULT is displayed in <3. SAFETY CHECK>. During the check, <3-1. OVER PRESS 1> blinks. Touching the STOP key stops the check.

   ii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 300 mmHg.

   iii) Once the <CUFF PRESSURE> value reaches 300 mmHg, apply pressure slowly from the rubber bulb.

   iv) During pressurization, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value shown in <3-1. OVER PRESS 1> is between 300 and 330 mmHg.

   While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.



```
                              *** NIBP CHECK ***
1.CALIBRATION                                6.STEP DEFLATION
    SENSOR 1    -0.7 mmHg    0342                6-1.V1 250mmHg       mmHg
    SENSOR 2    -3.3 mmHg    018E                6-2.V2 250mmHg       mmHg
2.ZERO CALIBRATION                  OK           6-3.V1  20mmHg       mmHg
3.SAFETY CHECK  --- ADULT                        6-4.V2  20mmHg       mmHg
    3-1.OVER PRESS 1 --- 324  mmHg OK        7.AIR LEAK
    3-2.OVER PRESS 2 ---          sec            30sec                mmHg
4.INFLATION SPEED                                90sec                mmHg
    4-1.ADULT        ---          sec            Diff                 mmHg
    4-2.NEONATAL     ---          sec        8.AIR CIRCUIT            mmHg
5.PRESSURE HOLD                              CUFF PRESSURE          0 mmHg
    10sec                     mmHg           OFFSET  ---          033D
    20sec                     mmHg           CUFF    ---          00
    Diff                      mmHg
                                                       SAFETY CIRCUIT ON
```

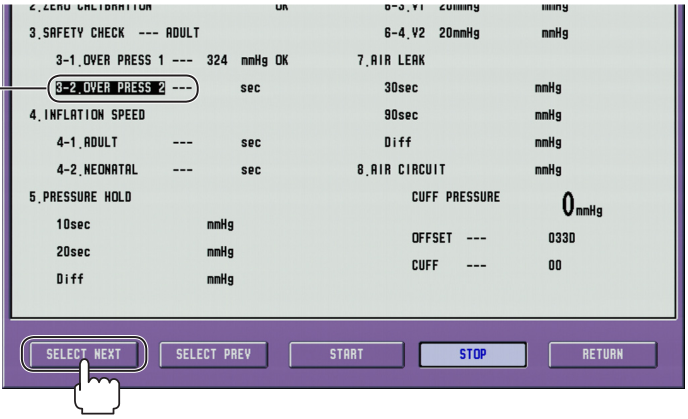
ADULT appears when an adult air hose is connected.

The pressurized value is displayed.

This is the pressurized value measured when the pressure limiter (safety circuit) is working. Check that the OK appears when the displayed value is between 300 and 330 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted.

v) Touch the SELECT NEXT key to highlight <3-2. OVER PRESS 2>.



```
3.SAFETY CHECK  --- ADULT                 6-4.V2  20mmHg        mmHg
   3-1.OVER PRESS 1 ---  324  mmHg OK    7.AIR LEAK
   3-2.OVER PRESS 2 ---        sec          30sec              mmHg
4.INFLATION SPEED                           90sec              mmHg
   4-1.ADULT        ---        sec          Diff               mmHg
   4-2.NEONATAL     ---        sec       8.AIR CIRCUIT         mmHg
5.PRESSURE HOLD                             CUFF PRESSURE      0mmHg
   10sec                 mmHg
                                            OFFSET  ---        033D
   20sec                 mmHg
                                            CUFF    ---        00
   Diff                  mmHg
```

<3-2. OVER PRESS 2> is highlighted.

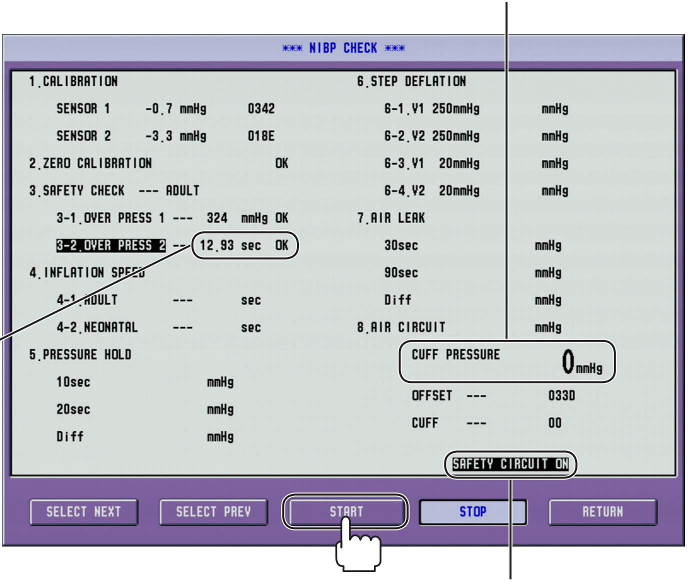
vi) Touch the START key to start the check procedure in <3-2. OVER PRESS 2>.
During the check, <3-2. OVER PRESS 2> blinks.
Touching the STOP key stops the check.

vii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 300 mmHg.

viii) Once the <CUFF PRESSURE> value reaches 300 mmHg, apply pressure slowly from the rubber bulb and keep the value for a while in the range from 300 to 310 mmHg.

ix) While the value is thus maintained, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value shown in <3-2. OVER PRESS 2> is between 0 and 15 seconds.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.



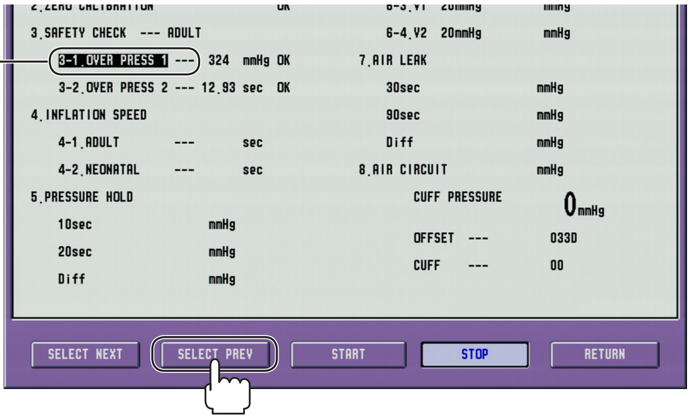
```
                          *** NIBP CHECK ***
1.CALIBRATION                            6.STEP DEFLATION
   SENSOR 1     -0.7 mmHg     0342          6-1.V1 250mmHg      mmHg
   SENSOR 2     -3.3 mmHg     018E          6-2.V2 250mmHg      mmHg
2.ZERO CALIBRATION                  OK      6-3.V1  20mmHg      mmHg
3.SAFETY CHECK  --- ADULT                   6-4.V2  20mmHg      mmHg
   3-1.OVER PRESS 1 ---  324  mmHg OK    7.AIR LEAK
   3-2.OVER PRESS 2 --- 12.93 sec  OK       30sec              mmHg
4.INFLATION SPEED                           90sec              mmHg
   4-1.ADULT        ---        sec          Diff               mmHg
   4-2.NEONATAL     ---        sec       8.AIR CIRCUIT         mmHg
5.PRESSURE HOLD                             CUFF PRESSURE      0mmHg
   10sec                 mmHg
                                            OFFSET  ---        033D
   20sec                 mmHg
                                            CUFF    ---        00
   Diff                  mmHg
                                              SAFETY CIRCUIT ON
```

The pressurized value is displayed.

The elapsed time, which is measured until the pressure limiter (safety circuit) starts operating, is displayed. Check that the OK appears when the displayed value is between 0 and 15 seconds.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted.

3. When the check in adult/child mode is completed, touch the SELECT PREV key to highlight <3-1. OVER PRESS 1>.



<3-1. OVER PRESS 1> is highlighted.

```
3.SAFETY CHECK  --- ADULT                          6-4.V2  20mmHg        mmHg
    3-1.OVER PRESS 1 ---  324  mmHg OK         7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.93 sec  OK             30sec                mmHg
4.INFLATION SPEED                                  90sec                mmHg
    4-1.ADULT        ---       sec                 Diff                 mmHg
    4-2.NEONATAL     ---       sec             8.AIR CIRCUIT            mmHg
5.PRESSURE HOLD                                    CUFF PRESSURE        0mmHg
    10sec                 mmHg
    20sec                 mmHg                     OFFSET  ---      033D
    Diff                  mmHg                     CUFF    ---      00
```

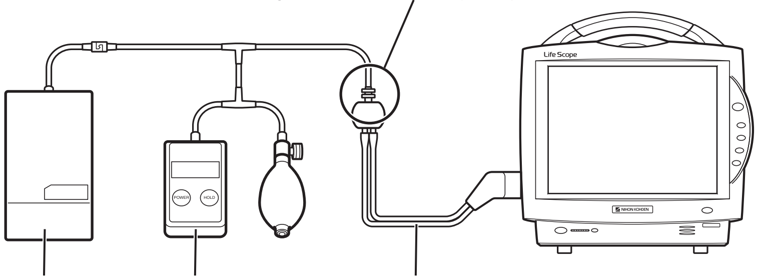
SELECT NEXT
SELECT PREV
START
STOP
RETURN

4. Run the check in neonatal mode.

   Checking in Neonatal Mode

   i) Using a neonatal air hose (3.5 m), reconnect between the bedside monitor and the manometer. Before connecting a neonatal air hose (3.5 m), change the CPC SMM-02 air joint to a VRS 306 luer fitting (male).

Change the CPC SMM-02 air joint to a VRS 306 lure fitting (male) before connecting a neonatal air hose (3.5 m).



Life Scope
Air tank
(700 cc)
Manometer
Reconnect by using
a neonatal air hose
(3.5 m).
Bedside monitor

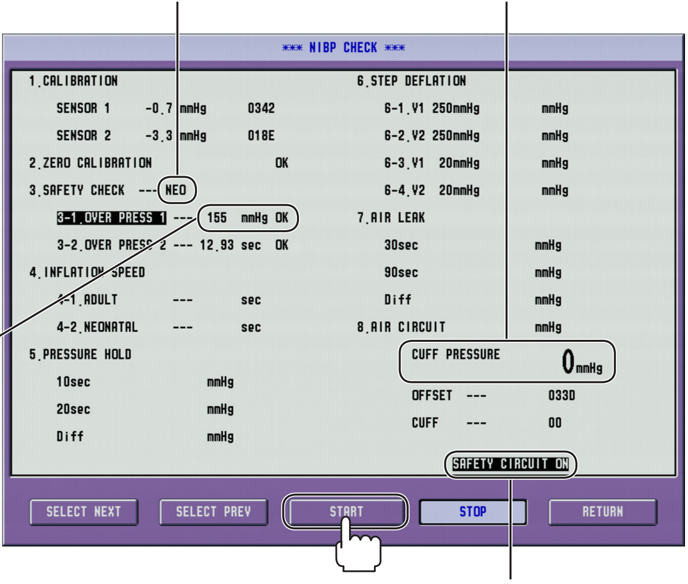
   ii) Touch the START key to start the check procedure in <3-1. OVER PRESS 1>. Check that NEO is displayed in <3. SAFETY CHECK>. During the check, <3-1. OVER PRESS 1> blinks.
   Touching the STOP key stops the check.

   iii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 150 mmHg.

   iv) Once the <CUFF PRESSURE> value reaches 150 mmHg, apply pressure slowly from the rubber bulb.

v) During pressurization, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value of <3-1. OVER PRESS 1> is between 150 and 165 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.



```
*** NIBP CHECK ***
1.CALIBRATION                              6.STEP DEFLATION
   SENSOR 1    -0.7 mmHg    0342              6-1.V1 250mmHg        mmHg
   SENSOR 2    -3.3 mmHg    018E              6-2.V2 250mmHg        mmHg
2.ZERO CALIBRATION               OK           6-3.V1  20mmHg        mmHg
3.SAFETY CHECK ---NEO                         6-4.V2  20mmHg        mmHg
   3-1.OVER PRESS 1 --- 155  mmHg OK       7.AIR LEAK
   3-2.OVER PRESS 2 --- 12.93 sec  OK         30sec                mmHg
4.INFLATION SPEED                             90sec                mmHg
   4-1.ADULT        ---      sec              Diff                 mmHg
   4-2.NEONATAL     ---      sec           8.AIR CIRCUIT           mmHg
5.PRESSURE HOLD                               CUFF PRESSURE       0mmHg
   10sec                mmHg                  OFFSET  ---        033D
   20sec                mmHg                  CUFF    ---        00
   Diff                 mmHg
                                                   SAFETY CIRCUIT ON
```

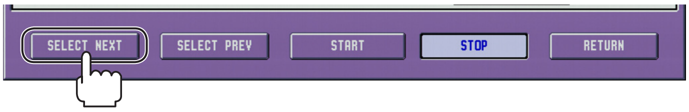
NEO appears if a neonatal air hose is connected.

The pressurized value is displayed.

This is the pressurized value measured when the pressure limiter (safety circuit) is working. Check that the OK appears when the displayed value is between 150 and 165 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted.

5. When the check in neonatal mode is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Pressurization Speed (4. INFLATION SPEED)” section.



Checking the Pressurization Speed (4. INFLATION SPEED)

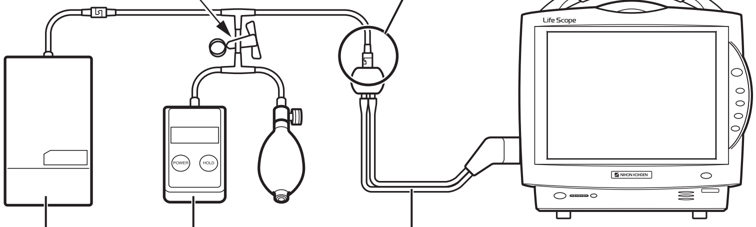
Check the pressurization speed in adult/child mode and in neonatal mode.

1. After the check in neonatal mode is run in the previous “Checking the Safety Circuit (3. SAFETY CHECK)” section, use an adult air hose (3.5 m) to reconnect between the bedside monitor and the manometer. Before connecting an adult air hose (3.5 m), change the VRS 306 luer fitting (male) to a CPC SMM-02 air joint.

2. Clamp the silicon tube which connects the manometer and the rubber bulb with a clip.

NOTE

Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb. Alternatively, you can remove the manometer and connect the air tank directly to the adult air hose (3.5 m).


Change the VRS 306 lure fitting (male) to a CPC SMM-02 air joint before connecting an adult air hose (3.5 m).
Use a clip to clamp the tube.
Life Scope
Air tank (700 cc)
Manometer
Reconnect by using an adult air hose (3.5 m).
Bedside monitor

3. Run the check in adult/child mode.

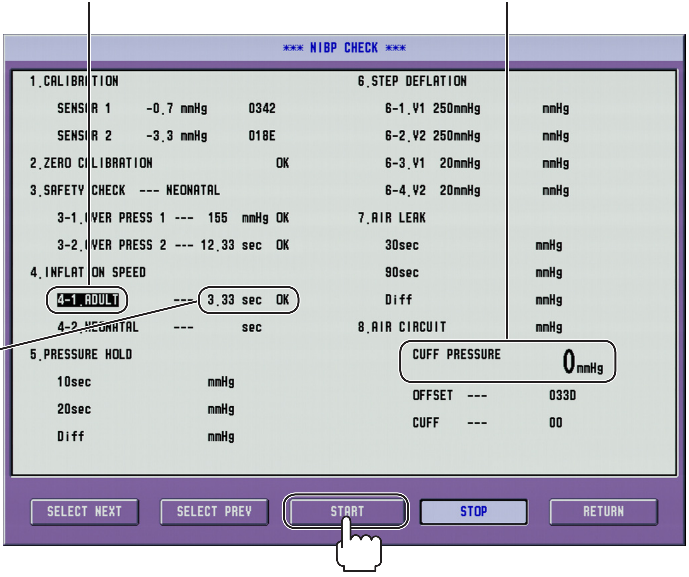
   <u>Checking in Adult/Child Mode</u>

   i) On the NIBP CHECK screen, check that <4-1. ADULT> is highlighted.
   ii) Touch the START key to start the check procedure in <4-1. ADULT>. During the check, <4-1. ADULT> blinks.
   Touching the STOP key stops the check.
   iii) Automatic pressurization is started. Pressurization continues until the <CUFF PRESSURE> value reaches 200 mmHg, and it is followed by air evacuation. Check the OK appears when the value displayed in <4-1. ADULT> is between 0 and 7 seconds.

Check that <4-1. ADULT> is highlighted.

The pressurized value is displayed.

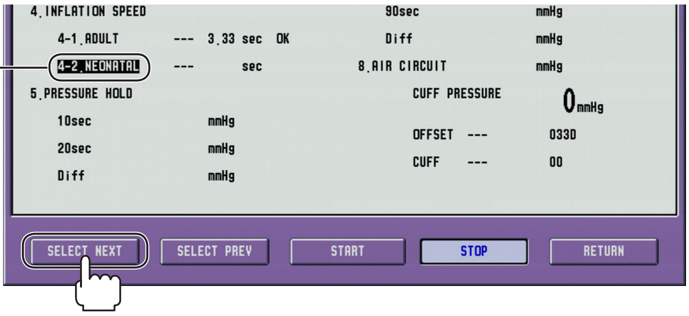
The pressurization time, which is measured until the <CUFF PRESSURE> value reaches 200 mmHg, is displayed. Check that the OK appears when the displayed value is between 0 and 7 seconds.



```
                         *** NIBP CHECK ***
1.CALIBRATION                                   6.STEP DEFLATION
    SENSOR 1     -0.7 mmHg     0342                 6-1.V1 250mmHg       mmHg
    SENSOR 2     -3.3 mmHg     018E                 6-2.V2 250mmHg       mmHg
2.ZERO CALIBRATION                    OK            6-3.V1  20mmHg       mmHg
3.SAFETY CHECK  --- NEONATAL                        6-4.V2  20mmHg       mmHg
    3-1.OVER PRESS 1 ---  155  mmHg OK          7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.33 sec  OK              30sec               mmHg
4.INFLATION SPEED                                   90sec               mmHg
    4-1.ADULT         --- 3.33 sec  OK              Diff                mmHg
    4-2.NEONATAL      ---       sec             8.AIR CIRCUIT           mmHg
5.PRESSURE HOLD                                   CUFF PRESSURE        0mmHg
    10sec                    mmHg                 OFFSET  ---          033D
    20sec                    mmHg                 CUFF    ---          00
    Diff                     mmHg
```

SELECT NEXT
SELECT PREV
START
STOP
RETURN

4. When the check in adult/child mode is completed, touch the SELECT NEXT key to highlight <4-2. NEONATAL>.



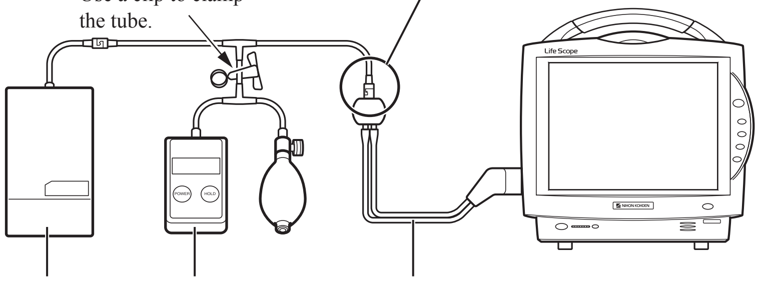
<4-2. NEONATAL> is highlighted.

```
4.INFLATION SPEED                          90sec          mmHg
  4-1.ADULT       --- 3.33 sec  OK         Diff           mmHg
  4-2.NEONATAL    ---      sec           8.AIR CIRCUIT    mmHg
5.PRESSURE HOLD                              CUFF PRESSURE   0mmHg
  10sec               mmHg
                                             OFFSET  ---     033D
  20sec               mmHg
                                             CUFF    ---     00
  Diff                mmHg
```

5. Run the check in neonatal mode.

Checking in Neonatal Mode

i) Replace the air tank with a 70 cc tank.



Use a clip to clamp the tube.

Change the VRS 306 lure fitting (male) to a CPC SMM-02 air joint before connecting an adult air hose (3.5 m).

Air tank (70 cc)

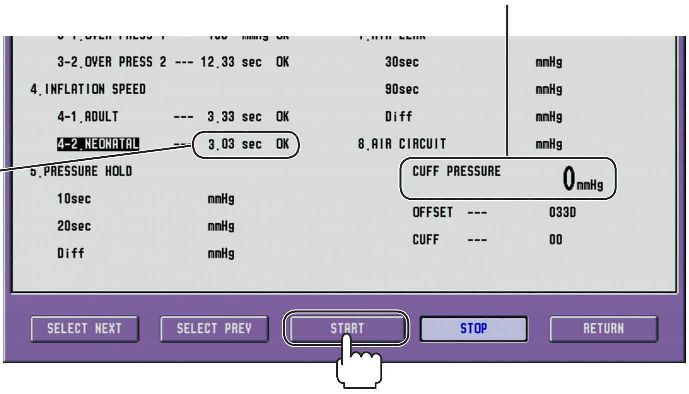
Manometer

Reconnect by using an adult air hose (3.5 m).

Bedside monitor

ii) Touch the START key to start the check procedure in <4-2. NEONATAL>.
During the check, <4-2. NEONATAL> blinks.
Touching the STOP key stops the check.

iii) Automatic pressurization is started. Pressurization continues until the <CUFF PRESSURE> value reaches 200 mmHg, and it is followed by air evacuation. Check that the OK appears when the value displayed in <4-2. NEONATAL> is between 0 and 5 seconds.

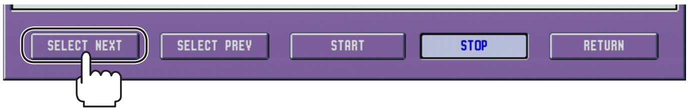


The pressurized value is displayed.

The pressurization time, which is measured until the <CUFF PRESSURE> value reaches 200 mmHg, is displayed. Check that the OK appears when the displayed value is between 0 and 5 seconds.

```
  3-2.OVER PRESS 2 --- 12.33 sec  OK       30sec          mmHg
4.INFLATION SPEED                          90sec          mmHg
  4-1.ADULT       --- 3.33 sec  OK         Diff           mmHg
  4-2.NEONATAL    --- 3.03 sec  OK       8.AIR CIRCUIT    mmHg
5.PRESSURE HOLD                              CUFF PRESSURE   0mmHg
  10sec               mmHg
                                             OFFSET  ---     033D
  20sec               mmHg
                                             CUFF    ---     00
  Diff                mmHg
```

6. When the check in neonatal mode is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Held Pressure (5. PRESSURE HOLD)” section.


SELECT NEXT
SELECT PREV
START
STOP
RETURN

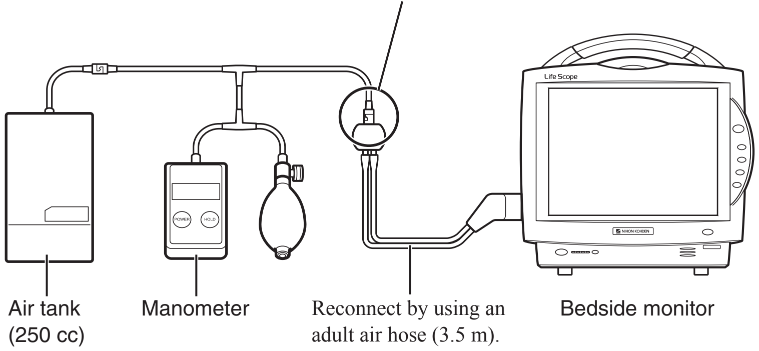
Checking the Held Pressure (5. PRESSURE HOLD)

Check the held pressure.

1. After you have performed the check in neonatal mode according to the previous “Checking the Pressurization Speed (4. INFLATION SPEED)” section, use an adult air hose (3.5 m) to reconnect between the bedside monitor and the manometer and remove the clip from the silicon tube connecting the manometer and the rubber bulb. Additionally, replace the air tank with a 250 cc tank. Before connecting an adult air hose (3.5 m), change the VRS 306 luer fitting (male) to a CPC SMM-02 air joint.

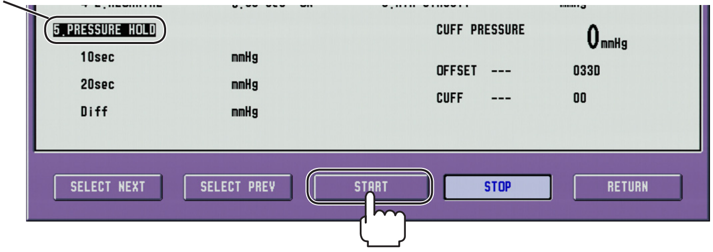
NOTE

Using an adult air hose (1.5 m) and a neonatal air hose prevents you from making accurate inspection in the following items.


Change the VRS 306 lure fitting (male) to a CPC SMM-02 air joint before connecting an adult air hose (3.5 m).

Air tank
(250 cc)
Manometer
Reconnect by using an adult air hose (3.5 m).
Bedside monitor
Life Scope

2. Run the check.
   i) On the NIBP CHECK screen, check that <5. PRESSURE HOLD> is highlighted and touch the START key. The <5. PRESSURE HOLD> starts blinking and the START key is replaced with the MEASURE START key.
   During the check, <5. PRESSURE HOLD> blinks.
   Touching the STOP key stops the check.

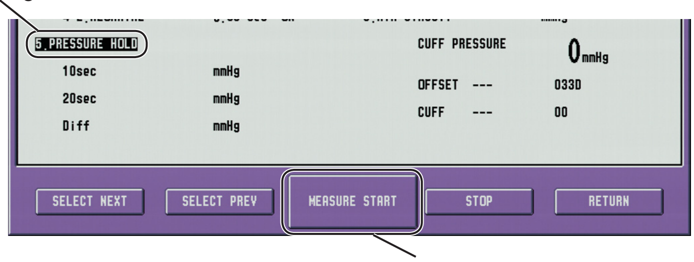

Check that <5. PRESSURE HOLD> is highlighted.

5.PRESSURE HOLD
10sec mmHg
20sec mmHg
Diff mmHg
CUFF PRESSURE 0 mmHg
OFFSET --- 033D
CUFF --- 00

SELECT NEXT
SELECT PREV
START
STOP
RETURN

⇩

Starts blinking.



```
5.PRESSURE HOLD                                    CUFF PRESSURE        0mmHg
    10sec              mmHg
    20sec              mmHg                        OFFSET  ---          033D
    Diff               mmHg                        CUFF    ---          00
```

Changed to MEASURE START.

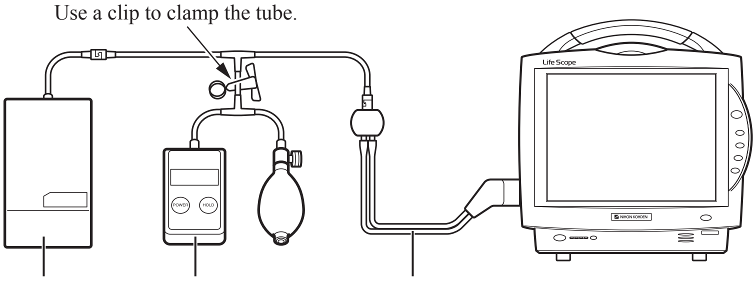
ii) Apply pressure from the rubber bulb until the <CUFF PRESSURE> value reaches 250 mmHg.

iii) When the <CUFF PRESSURE> value reaches 250 mmHg, use a clip to clamp the silicon tube connecting the manometer and the rubber bulb, thus stopping the pressurization.

NOTE

Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb.

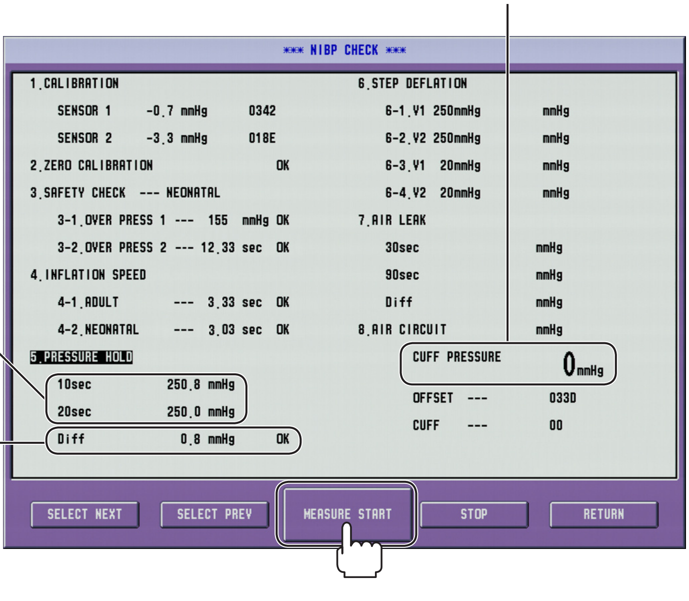
Use a clip to clamp the tube.



iv) Touch the MEASURE START key to start the test.

v) The “CUFF PRESSURE” values of 10 and 20 seconds later (10 sec and 20 sec) and the difference (Diff) between them are automatically measured. Check that the Diff value does not exceed 5 mmHg and the OK appears.

The pressurized value is displayed.

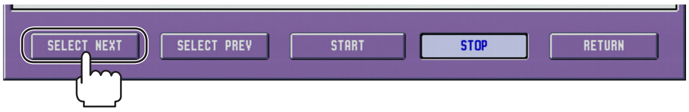


```
*** NIBP CHECK ***
1.CALIBRATION                                  6.STEP DEFLATION
    SENSOR 1     -0.7 mmHg     0342                6-1.V1 250mmHg      mmHg
    SENSOR 2     -3.3 mmHg     018E                6-2.V2 250mmHg      mmHg
2.ZERO CALIBRATION                  OK             6-3.V1  20mmHg      mmHg
3.SAFETY CHECK  --- NEONATAL                       6-4.V2  20mmHg      mmHg
    3-1.OVER PRESS 1 ---  155  mmHg OK         7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.33 sec  OK             30sec              mmHg
4.INFLATION SPEED                                  90sec              mmHg
    4-1.ADULT        ---  3.33 sec  OK             Diff               mmHg
    4-2.NEONATAL     ---  3.03 sec  OK         8.AIR CIRCUIT          mmHg
5.PRESSURE HOLD                                 CUFF PRESSURE        0mmHg
    10sec            250.8 mmHg
    20sec            250.0 mmHg                 OFFSET  ---          033D
    Diff               0.8 mmHg     OK          CUFF    ---          00
```

10sec, 20sec
These are the pressurized values measured in 10 and 20 seconds after the MEASURE START key is touched.

Diff
This displays the difference between the 10sec and 20sec items. Check that the OK appears and the measured value does not exceed 5 mmHg.

3. When the check is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Operation of the Solenoid Valve (6. STEP DEFLATION)” section.


SELECT NEXT
SELECT PREV
START
STOP
RETURN

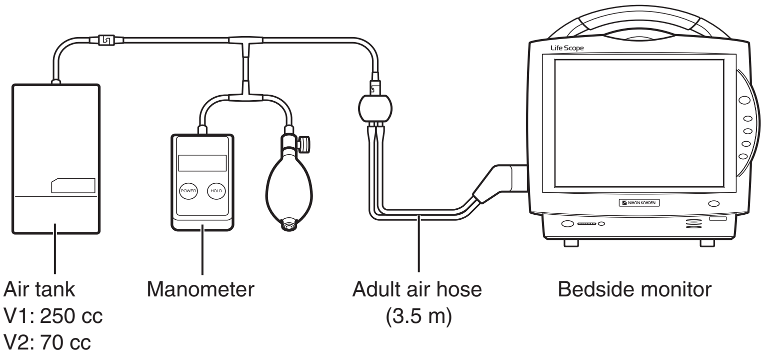
Checking the Operation of the Solenoid Valve (6. STEP DEFLATION)

Check the operation of the quick exhaust valve (V1) and the slow exhaust valve (V2).

1. Reconfirm that the following components are connected as shown: the bedside monitor, an adult air hose (3.5 m), a manometer, and an air tank.

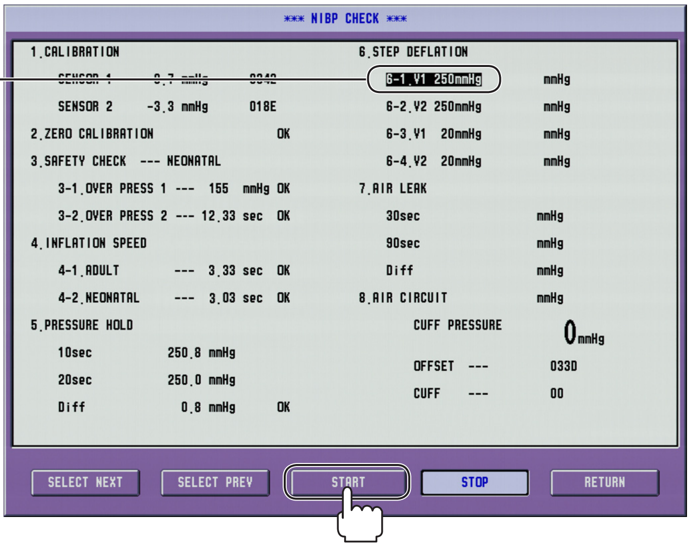
NOTE

- Using an adult air hose (1.5 m) and a neonatal air hose prevents you from making accurate inspection.
- Change the capacity of an air tank, depending on the check items.


Life Scope
Air tank
V1: 250 cc
V2: 70 cc
Manometer
Adult air hose
(3.5 m)
Bedside monitor

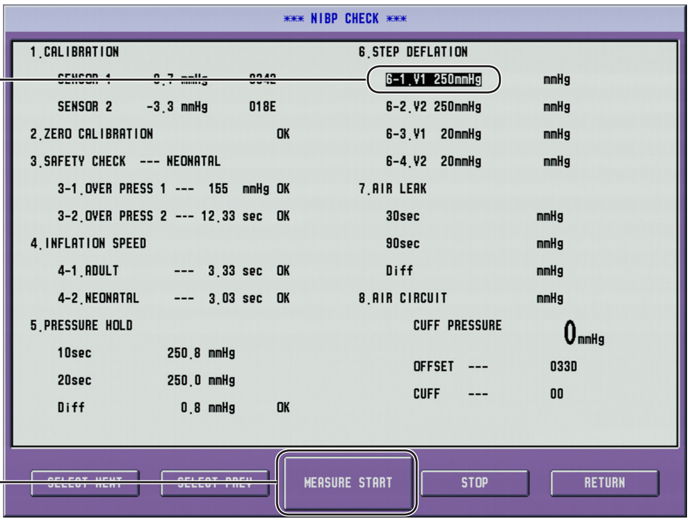
2. Repeat steps i) to v) to check all of the following items: <6-1. V1 250 mmHg>, <6-2. V2 250 mmHg>, <6-3. V1 20 mmHg>, and <6-4. V2 20 mmHg>.

i) On the NIBP CHECK screen, check that the check items are highlighted and touch the START key. The check item starts blinking and the START key is replaced with the MEASURE START key.
During the check, each of the check items blinks.
Touching the STOP key stops the check.



```
*** NIBP CHECK ***
1.CALIBRATION                                  6.STEP DEFLATION
    SENSOR 1      0.7 mmHg     0342                6-1.V1  250mmHg        mmHg
    SENSOR 2     -3.3 mmHg     018E                6-2.V2 250mmHg         mmHg
2.ZERO CALIBRATION                 OK              6-3.V1   20mmHg        mmHg
3.SAFETY CHECK  --- NEONATAL                       6-4.V2   20mmHg        mmHg
    3-1.OVER PRESS 1 ---   155  mmHg OK        7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.33 sec   OK            30sec                 mmHg
4.INFLATION SPEED                                  90sec                 mmHg
    4-1.ADULT       ---  3.33 sec   OK             Diff                  mmHg
    4-2.NEONATAL    ---  3.03 sec   OK         8.AIR CIRCUIT             mmHg
5.PRESSURE HOLD                                        CUFF PRESSURE     0mmHg
    10sec           250.8 mmHg                         OFFSET  ---       033D
    20sec           250.0 mmHg                         CUFF    ---       00
    Diff              0.8 mmHg      OK
```

Check that the check item is highlighted.



```
*** NIBP CHECK ***
1.CALIBRATION                                  6.STEP DEFLATION
    SENSOR 1      0.7 mmHg     0342                6-1.V1  250mmHg        mmHg
    SENSOR 2     -3.3 mmHg     018E                6-2.V2 250mmHg         mmHg
2.ZERO CALIBRATION                 OK              6-3.V1   20mmHg        mmHg
3.SAFETY CHECK  --- NEONATAL                       6-4.V2   20mmHg        mmHg
    3-1.OVER PRESS 1 ---   155  mmHg OK        7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.33 sec   OK            30sec                 mmHg
4.INFLATION SPEED                                  90sec                 mmHg
    4-1.ADULT       ---  3.33 sec   OK             Diff                  mmHg
    4-2.NEONATAL    ---  3.03 sec   OK         8.AIR CIRCUIT             mmHg
5.PRESSURE HOLD                                        CUFF PRESSURE     0mmHg
    10sec           250.8 mmHg                         OFFSET  ---       033D
    20sec           250.0 mmHg                         CUFF    ---       00
    Diff              0.8 mmHg      OK
```

Starts blinking.

Changed to the MEASURE START key.

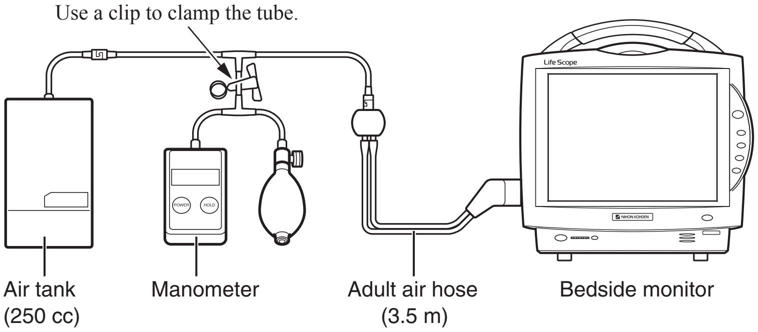
ii) Apply pressure from the rubber bulb until the <CUFF PRESSURE> value reaches the value shown below. (For details about the pressurized value, refer to the table below.)

Item Name	Air Tank Capacity	<CUFF PRESSURE> Value
6-1.V1 250 mmHg	250 cc	250 mmHg
6-2.V2 250 mmHg	70 cc	
6-3.V1 20 mmHg	250 cc	20 mmHg
6-4.V2 20 mmHg	70 cc	

iii) When the <CUFF PRESSURE> value reaches 250 mmHg, use a clip to clamp the silicon tube connecting the manometer and the rubber bulb, thus stopping the pressurization.

NOTE

Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb.

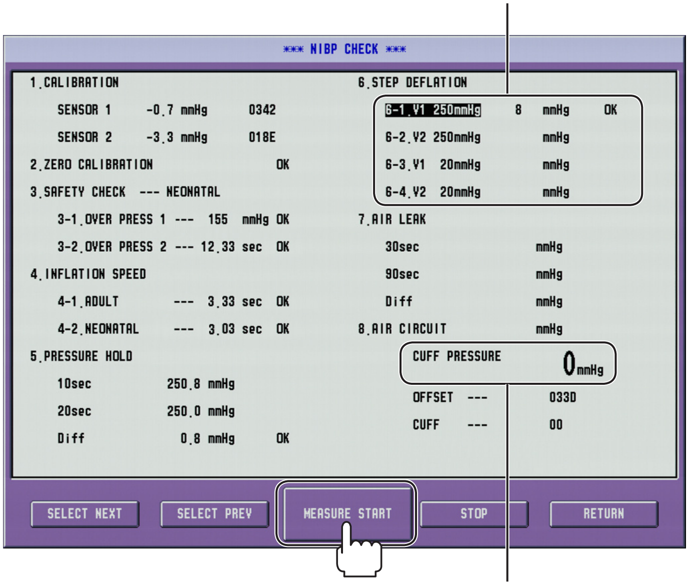

Use a clip to clamp the tube.
Air tank
(250 cc)
Manometer
Adult air hose
(3.5 m)
Bedside monitor
Life Scope

iv) Touch the MEASURE START key to start the test.

v) Check that the OK appears when the measured value shown in each item meets the requirement of the table below.

Item Name	Air Tank Capacity	Measured Value
6-1.V1 250 mmHg	250 cc	7 to 23 mmHg
6-2.V2 250 mmHg	70 cc	5 to 15 mmHg
6-3.V1 20 mmHg	250 cc	2 to 8 mmHg
6-4.V2 20 mmHg	70 cc	

Check the measured value of each item and the OK appear.

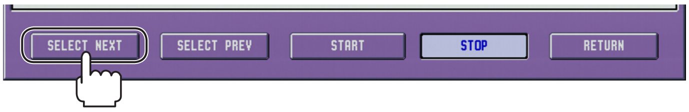


```
*** NIBP CHECK ***

1.CALIBRATION                                    6.STEP DEFLATION
    SENSOR 1      -0.7 mmHg      0342              6-1.V1 250mmHg    8   mmHg    OK
    SENSOR 2      -3.3 mmHg      018E              6-2.V2 250mmHg        mmHg
2.ZERO CALIBRATION                 OK              6-3.V1  20mmHg        mmHg
3.SAFETY CHECK  --- NEONATAL                       6-4.V2  20mmHg        mmHg
    3-1.OVER PRESS 1 ---   155  mmHg OK          7.AIR LEAK
    3-2.OVER PRESS 2 --- 12.33 sec   OK              30sec                mmHg
4.INFLATION SPEED                                    90sec                mmHg
    4-1.ADULT        ---  3.33 sec   OK              Diff                 mmHg
    4-2.NEONATAL     ---  3.03 sec   OK          8.AIR CIRCUIT            mmHg
5.PRESSURE HOLD                                      CUFF PRESSURE         0mmHg
    10sec            250.8 mmHg                      OFFSET  ---          033D
    20sec            250.0 mmHg                      CUFF    ---          00
    Diff               0.8 mmHg      OK
```

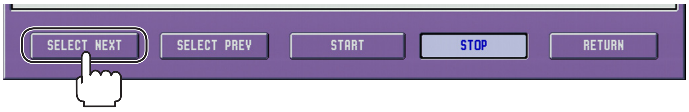
SELECT NEXT
SELECT PREV
MEASURE START
STOP
RETURN

The pressurized value is displayed.

vi) Touch the SELECT NEXT key to highlight the next check item.


SELECT NEXT
SELECT PREV
START
STOP
RETURN

3. Once the check ranging from <6-1. V1 250 mmHg> to <6-4. V2 20 mmHg> is completed, touch the SELECT NEXT key twice to perform the procedure shown in the next “Checking the Operation of the Circuit (8. AIR CIRCUIT)” section.

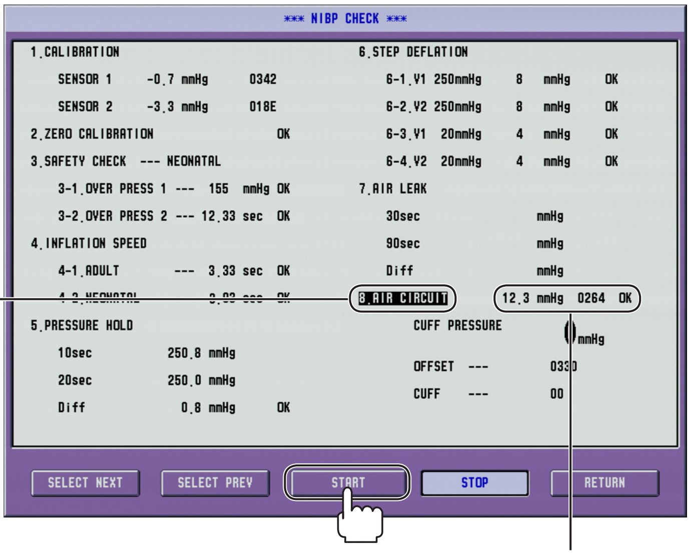

SELECT NEXT
SELECT PREV
START
STOP
RETURN

Checking the Operation of the Air Circuit (8. AIR CIRCUIT)

Check the operation of the air circuit.

1. Remove the air hose from the NIBP socket.

2. Run the check.
   i) On the NIBP CHECK screen, check that <8. AIR CIRCUIT> is highlighted and touch the START key. Automatic check is started.
   During the check, <8. AIR CIRCUIT> blinks.
   Touching the STOP key stops the check.
   ii) When the check is completed, check that the measured value and the OK appear in <8. AIR CIRCUIT>.



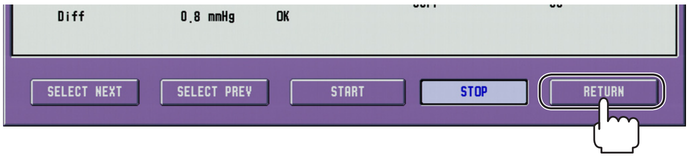
```
                          *** NIBP CHECK ***
1.CALIBRATION                              6.STEP DEFLATION
   SENSOR 1     -0.7 mmHg      0342           6-1.V1 250mmHg    8   mmHg    OK
   SENSOR 2     -3.3 mmHg      018E           6-2.V2 250mmHg    8   mmHg    OK
2.ZERO CALIBRATION                  OK        6-3.V1  20mmHg    4   mmHg    OK
3.SAFETY CHECK  --- NEONATAL                  6-4.V2  20mmHg    4   mmHg    OK
   3-1.OVER PRESS 1 ---  155  mmHg OK       7.AIR LEAK
   3-2.OVER PRESS 2 --- 12.33 sec  OK         30sec                 mmHg
4.INFLATION SPEED                             90sec                 mmHg
   4-1.ADULT        ---  3.33 sec  OK         Diff                  mmHg
   4-2.NEONATAL          3.03 sec  OK       8.AIR CIRCUIT      12.3 mmHg  0264  OK
5.PRESSURE HOLD                                  CUFF PRESSURE          0mmHg
   10sec          250.8 mmHg
   20sec          250.0 mmHg                     OFFSET  ---       0330
   Diff             0.8 mmHg       OK            CUFF    ---       00
```

SELECT NEXT
SELECT PREV
START
STOP
RETURN

Check that <8. AIR CIRCUIT> is highlighted.

Check that the measured value and the OK appear.

3. Touch the RETURN key to return to the MANUAL CHECK screen.


Diff 0.8 mmHg OK
SELECT NEXT
SELECT PREV
START
STOP
RETURN

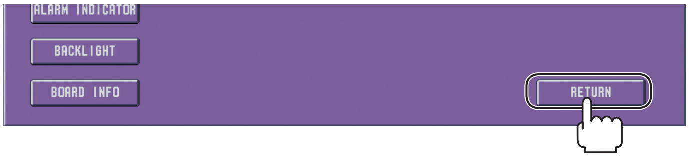
Checking on the Home Screen

Perform the procedures from <17. Checking the Date and Time> to <26. Checking the Battery Operation> on the home screen. Checking on the home screen requires you to change the system setup, alarm, and other settings. Before changing the system setup, alarm, and other settings, write down the current settings because they must be reset after maintenance is completed.

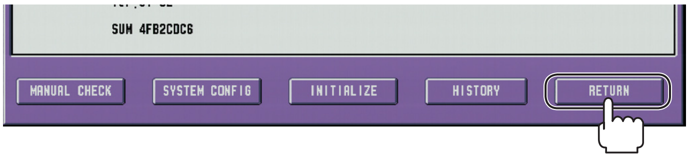
Displaying the Home screen

Perform the procedures from <17. Checking the Date and Time> to <26. Checking the Battery Operation> on the home screen referring to the following sections. Refer to this section to display the home screen after checking on the MANUAL CHECK screen, and go to the particular section for the specific check procedure.

1. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.



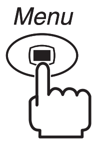
2. On the DIAGNOSTIC CHECK screen, touch the RETURN key to display the home screen.



```
SUM 4FB2CDC6
```

Checking the Date and Time

Check that the date and time settings of the monitor main unit are correct.



1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.

2. Touch the DATE key on the MENU window to display the DATE window. Alternatively, you can touch the clock displayed at the top right of the home screen to display the DATE window.

3. Check that the date and time displayed on the DATE window are correct. If the displayed date and time are not correct, reset them.

4. Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
   - Touching the waveform display area
   - Touching the HOME function key
     (Only when the function key is registered.)

Checking the Electrocardiogram (ECG)

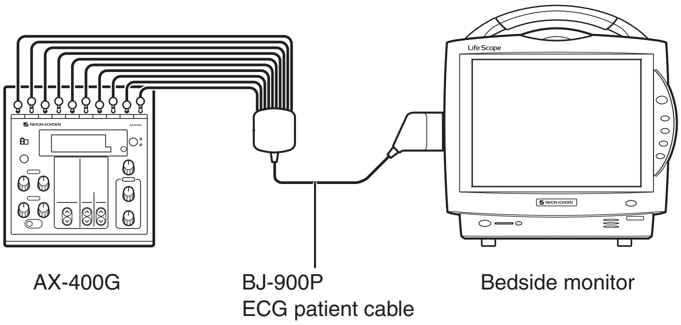
Connect the AX-400G vital sign simulator to the bedside monitor, and check the accuracy of the heart rate as well as the amplitude of ECGs in each lead. Additionally, check if the alarm works normally.

After the check, return the current settings to your own settings.

Preparations

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the BJ-900P ECG patient cable.



Setting

Set the following items on the bedside monitor.

- ECG window

ECG Window		Setting Item
MAIN setting	**SENSITIVITY**	×1
	LEAD	II
OTHER setting	**FILTERS**	DIAG
	NUMBER OF ELECTRODES	STANDARD
	SYNC SOURCE	ECG

- Record window in SETUP window

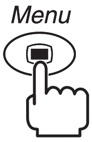
RECORD Window			Setting Item
REC PARAMS setting	**TRACES**	**TRACE 1**	ECG
		TRACE 2	NONE
		TRACE 3	

- Record window in SYSTEM SETUP window

Record Window		Setting Item
Recorder	**Manual recording**	Real time recording

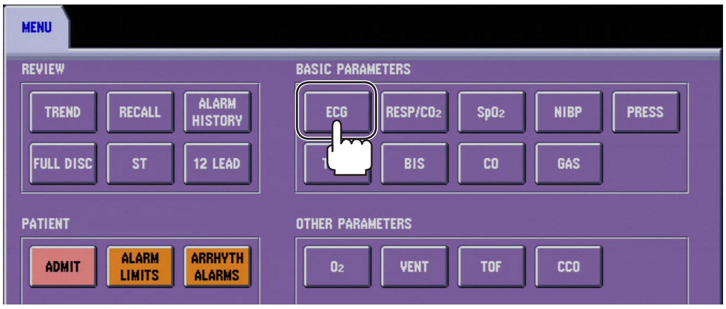
<Setting the Parameter Window>

Example: When setting on the OTHER page of the ECG window

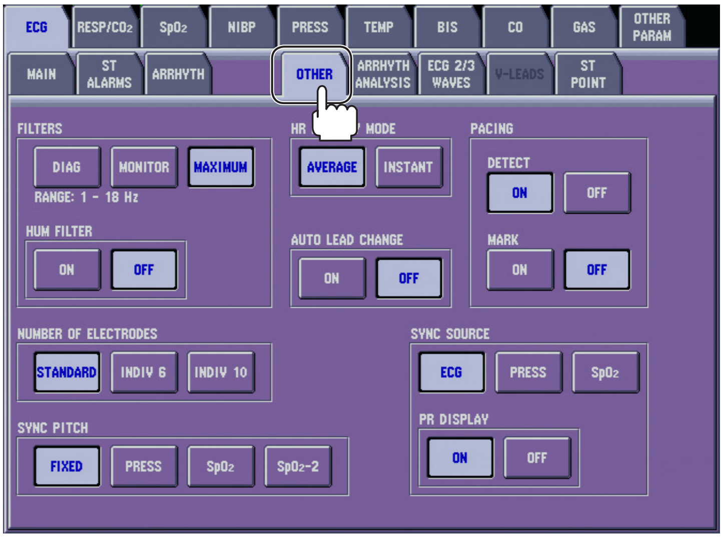


1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window only when the function key is registered.

2. Touch the ECG key to display the ECG window.


MENU
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO2
SpO2
NIBP
PRESS
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O2
VENT
TOF
CCO

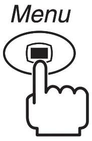
3. Touch the OTHER tab to set individual items.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF
NUMBER OF ELECTRODES
STANDARD
INDIV 6
INDIV 10
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2

4. Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
   - Touching the waveform display area
   - Touching the HOME function key
     (Only when the function key is registered.)

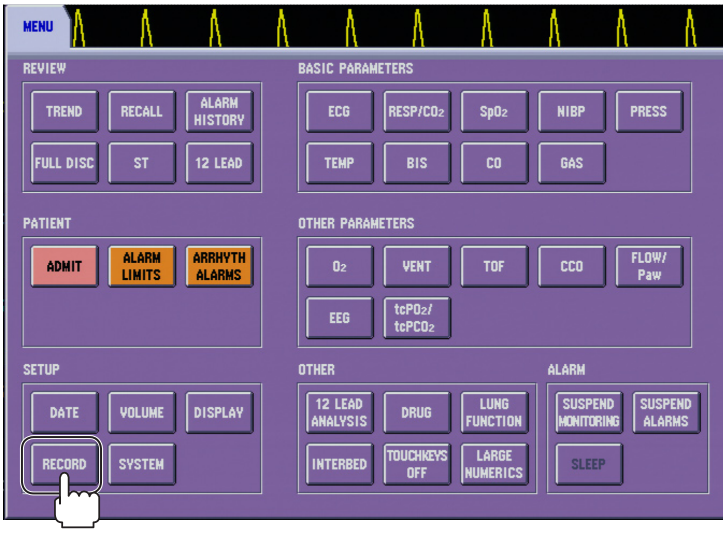
<Setting the Setup Window>

Example: When setting ECG for TRACE 1 on the REC PARAMS page of the RECORD window

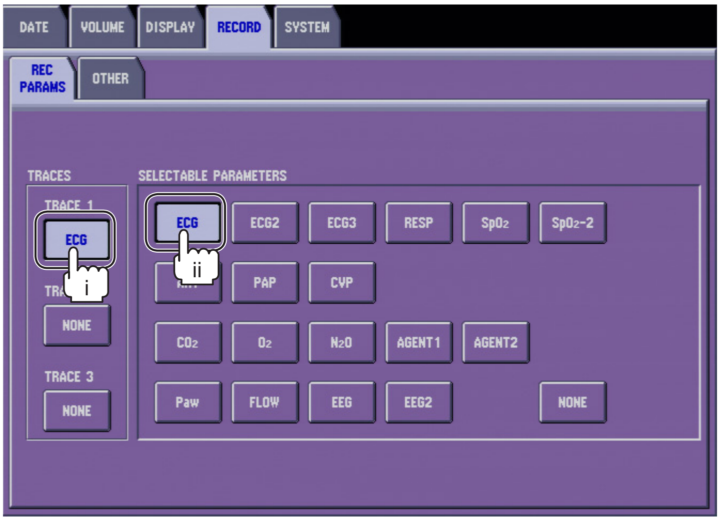


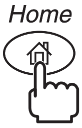
1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.

2. Touch the RECORD key to display the RECORD window.


MENU
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
SETUP
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
OTHER
12 LEAD ANALYSIS
DRUG
LUNG FUNCTION
INTERBED
TOUCHKEYS OFF
LARGE NUMERICS
ALARM
SUSPEND MONITORING
SUSPEND ALARMS
SLEEP

3. Set the ECG trace.
   i) Touch the ECG key in <TRACES> box.
   ii) Touch the ECG key in <SELECTABLE PARAMETERS> box.

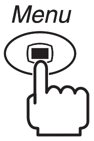

DATE
VOLUME
DISPLAY
RECORD
SYSTEM
REC PARAMS
OTHER
TRACES
TRACE 1
ECG
i
TR
NONE
TRACE 3
NONE
SELECTABLE PARAMETERS
ECG
ii
ECG2
ECG3
RESP
SpO2
SpO2-2
PAP
CVP
CO2
O2
N2O
AGENT1
AGENT2
Paw
FLOW
EEG
EEG2
NONE



4. Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
   - Touching the waveform display area
   - Touching the HOME function key (Only when the function key is registered.)

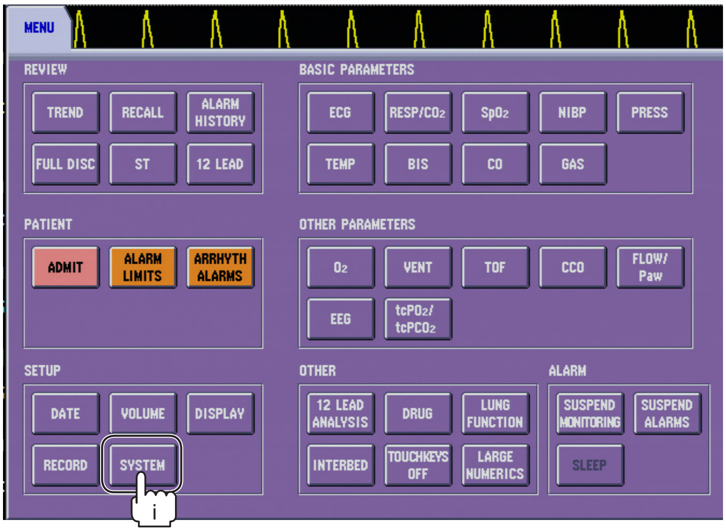
<Setting the SYSTEM SETUP window>

Example: When setting REAL TIME for <MANUAL RECORD> on the RECORDER window

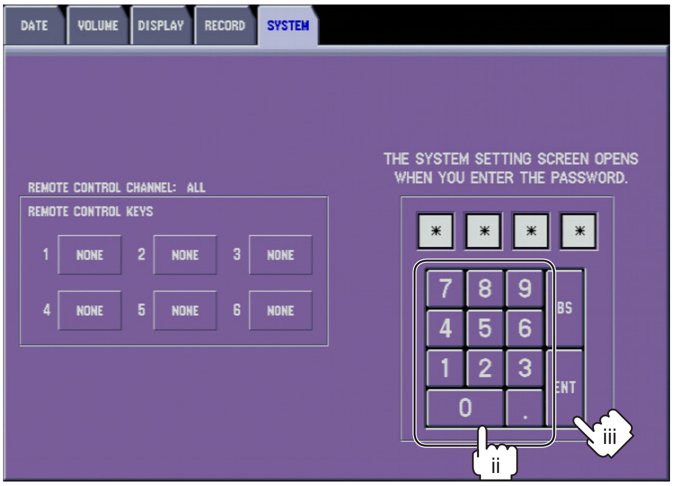


1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.

2. Perform the following steps i) to iii) to display the SYSTEM SETUP window.
   i) Touch the SYSTEM key.


MENU
REVIEW
TREND
RECALL
ALARM HISTORY
FULL DISC
ST
12 LEAD
BASIC PARAMETERS
ECG
RESP/CO₂
SpO₂
NIBP
PRESS
TEMP
BIS
CO
GAS
PATIENT
ADMIT
ALARM LIMITS
ARRHYTH ALARMS
OTHER PARAMETERS
O₂
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO₂/ tcPCO₂
SETUP
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
OTHER
12 LEAD ANALYSIS
DRUG
LUNG FUNCTION
INTERBED
TOUCHKEYS OFF
LARGE NUMERICS
ALARM
SUSPEND MONITORING
SUSPEND ALARMS
SLEEP
i

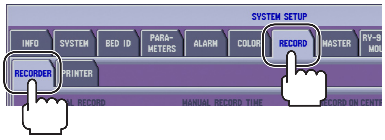
   ii) Using the numeric keypad in the password entry area, enter a four-digit password (consisting of numeric data). The password is set at the initial value of 1234. You can change your password on the CHANGE PASSWORD window in the SYSTEM CONFIGURATION screen.
   iii) Touch the ENT key. When the correct password is entered, the SYSTEM SETUP window appears.



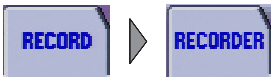
REMOTE CONTROL CHANNEL: ALL

THE SYSTEM SETTING SCREEN OPENS WHEN YOU ENTER THE PASSWORD.

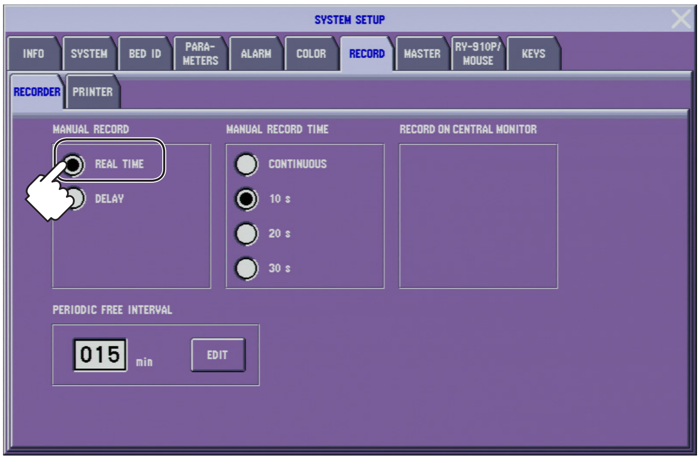
DATE
VOLUME
DISPLAY
RECORD
SYSTEM
REMOTE CONTROL KEYS
1 NONE
2 NONE
3 NONE
4 NONE
5 NONE
6 NONE
* * * *
7 8 9
4 5 6
1 2 3
0 .
BS
ENT
ii
iii


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RECORDER
PRINTER

3. Display the RECORDER page of the RECORD window.
   Touch the RECORD → RECORDER tab.


RECORD
RECORDER

4. Select REAL TIME for <MANUAL RECORD>.

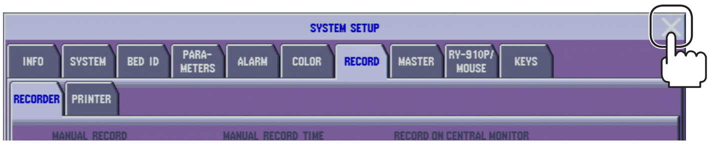

SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910PA MOUSE
KEYS
RECORDER
PRINTER
RECORD ON CENTRAL MONITOR
EDIT

MANUAL RECORD
● REAL TIME
○ DELAY

MANUAL RECORD TIME
○ CONTINUOUS
● 10 s
○ 20 s
○ 30 s

PERIODIC FREE INTERVAL
015 min

5. Press the [Home] key or touch ☒ on the SYSTEM SETUP window to return to the home screen. Alternatively, you can use the remote controller.


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910PA MOUSE
KEYS
RECORDER
PRINTER
MANUAL RECORD
MANUAL RECORD TIME
RECORD ON CENTRAL MONITOR

Additionally, you can also use the following operations to return to the home screen.

- Touching the area for displaying the waveform or short trend
- Touching the HOME function key
  (Only when the function key is registered.)

Checking the Accuracy of the Heart Rate and the Generation of Synchronous Sound

Set the heart rate in ECGs produced from the AX-400G vital sign simulator in the following way and check that the heart rate displayed on the bedside monitor is within the accuracy shown in the table below. Additionally, check that there is a sound synchronous with the QRS.

Setting on the AX-400G	Display on the Bedside Monitor
HR 20	18 to 22 beat/min
HR 60	58 to 62 beat/min
HR 180	178 to 182 beat/min

Checking the Detection of the Heart Rate and Electrode-Off Alarms

Check that the alarms for the upper and lower limits of the heart rate and for the electrode-off event are normally generated.

1. Set the ECG window for basic parameter on the bedside monitor.

ECG Window		Setting Item
MAIN setting	**HR/PR ALARM**	Lower limit: 70
	LEAD	II

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator to “HR 60” and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Display of the heart rate	Numerical data is highlighted.
Message display	Turning ON/OFF arrhythmia analysis displays the following messages. • Arrhythmia analysis “ON”: BRADYCARDIA • Arrhythmia analysis “OFF”: HR alarm
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The Arrhythmia analysis ON/OFF is selected on the ARRHYTHMIA ANALYSIS page of the ECG window.

3. Check that the bedside monitor works in the following way when you remove any of the lead wires connected to the AX-400G vital sign simulator.

Alarm	Operation of the Bedside Monitor
Message display	The “ECG CHECK ELECTRODE _ _” message appears. * When the RF is removed, the electrode name is not displayed.
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

Checking the Respiration

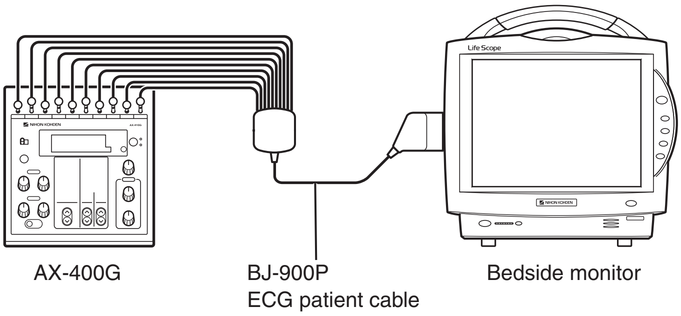
Connect the AX-400G vital sign simulator to the bedside monitor and check the accuracy of the respiration rate. Additionally, check that the alarm is normally generated.

After the check, return the current settings to your own settings.

Preparation

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the BJ-900P ECG patient cable.



Checking the Accuracy of the Respiration Rate

Check the accuracy of the respiration rate.

1. Set the RESP/CO_2 window for basic parameter as follows.

RESP/CO_2 Window		Setting Item
MAIN setting	**IMPEDANCE RESP LEAD**	R-F
	SENSITIVITY	×1

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator at "HR 60" and check that the respiration rate displayed on the bedside monitor is within the range from 18 to 22 count/min. The respiration rate generated from the AX-400G vital sign simulator is 20 count/min.

Checking the Detection of Alarms for the Respiration Rate

Check that alarms for the upper and lower limits of the respiration rate are normally generated.

1. Set the RESP/CO_2 window for basic parameter as follows.

RESP/CO_2 Window		Setting Item
MAIN setting	**RR ALARM**	Lower limit: 30

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator to "HR 60" and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Display of the respiration rate	Numerical data is highlighted.
Message display	The "RESP (IMP) Alarm" message appears.
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

Checking the SpO_2 Value

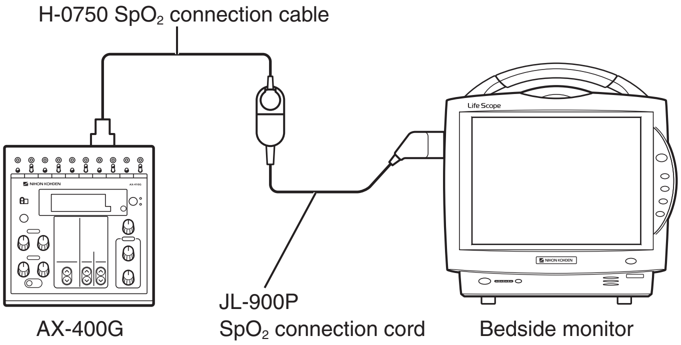
Connect the AX-400G vital sign simulator to the bedside monitor to check the SpO_2 value and the accuracy of the pulse rate. Additionally, check that the alarm is normally generated.

After the check, return the current settings to your own settings.

Preparation

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the JL-900P SpO_2 connection cord and H-0750 SpO_2 connection cable.



Checking the Accuracy of the SpO_2 Value and the Pulse Rate

Check the accuracy of the SpO_2 value and the pulse rate.

1. Set the SpO_2 window for basic parameters as follows.

SpO_2 Window		Setting Item
OTHER setting	**SYNC SOURCE**	SpO_2

2. Set the SpO_2 value produced from the AX-400G vital sign simulator in the following way and check that the SpO_2 value and the pulse rate (SpO_2-PR) displayed on the bedside monitor are within the accuracy shown in the table below. Additionally, check that there is a sound synchronous with the pulse wave.

Setting on the AX-400G		Display on the Bedside Monitor
SpO_2	**97% SpO_2**	95 to 99% SpO_2
	80% SpO_2	78 to 82% SpO_2
	70% SpO_2	66 to 74% SpO_2
SpO_2-PR	**60 bpm***	57 to 63 bpm

* The pulse rate (SpO_2-PR) generated from the AX-400G vital sign simulator is fixed at 60 bpm. No setting is required.

Checking the Detection of Alarm for the SpO_2 Value and a Connector-Off Alarm

Check that alarms for the upper and lower limits of the SpO_2 value and a connector-off alarm are normally generated.

1. Set the SpO_2 window on the bedside monitor as follows.

SpO_2 Window		Setting Item
MAIN setting	**SpO_2 alarm**	Lower limit: 90

2. Set the SpO_2 value produced from the AX-400G vital sign simulator to “80” and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Displaying the SpO_2 value	Numerical data is highlighted.
Message display	SpO_2 alarm
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

3. Check that the bedside monitor works in the following way when you remove the SpO_2 connection cable and the SpO_2 connection cord.

Alarm	Operation of the Bedside Monitor
Message display	The “SpO_2 CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is produced.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

Checking the IBP

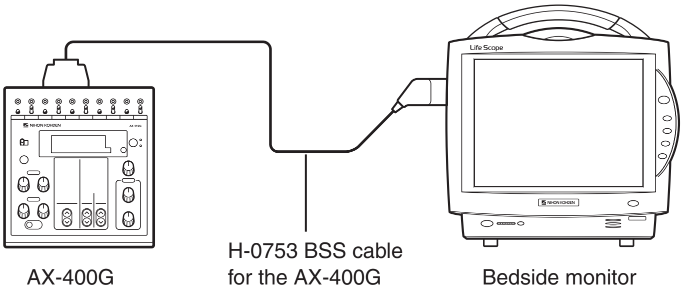
Connect the AX-400G vital sign simulator to the bedside monitor to check zero calibration and the accuracy of the blood pressure value. Check with all MULTI sockets.

After the check, return the current settings to your own settings.

Preparation

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.

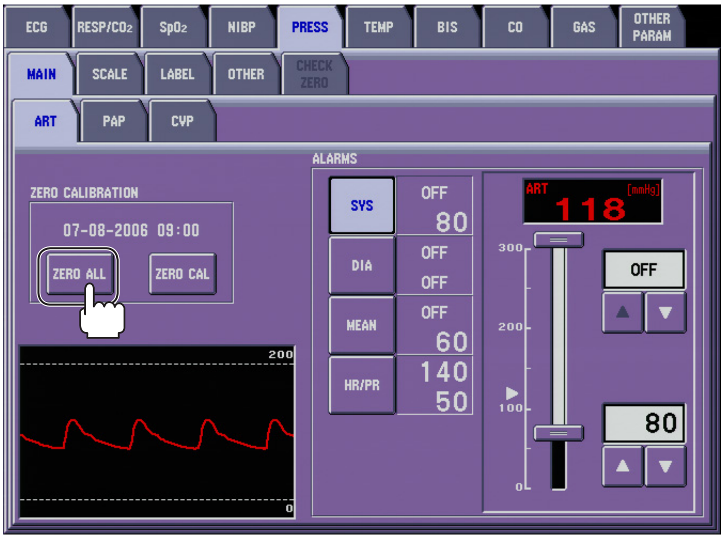


Checking the Accuracy of Zero Calibration

Check the accuracy of zero calibration.

1. Set the AX-400G vital sign simulator to “CAL 0 mmHg.”

2. Touch PRESS → MAIN → ART tab. Touch the ZERO ALL key to perform zero calibration. Check that the blood pressure displayed after calibration is within the range of –2 to 2 mmHg. Alternatively, you can touch the ZERO ALL function key to perform all-zero calibration if the function key is registered.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
ALARMS
ZERO CALIBRATION
07-08-2006 09:00
ZERO ALL
ZERO CAL
200
0
SYS
OFF
80
DIA
OFF
OFF
MEAN
OFF
60
HR/PR
140
50
ART
[mmHg]
118
300
200
100
0
OFF
80

Checking the Accuracy of the Blood Pressure Value

Check the accuracy of the blood pressure value. After performing the zero calibration, set the blood pressure value produced from the AX-400G vital sign simulator in the following way and check that the blood pressure value displayed on the bedside monitor meets the requirement of the table below.

Setting on the AX-400G	Display on the Bedside Monitor
10 mmHg	8 to 12 mmHg
100 mmHg	96 to 104 mmHg
250 mmHg	242 to 258 mmHg

Checking the Detection of an Connector-Off Alarm

Check that the connector-off alarm is normally generated. While the blood pressure signal is being entered from the AX-400G vital sign simulator, remove the connector for the blood pressure cable from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The “PRESS CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

Checking the Temperature

Connect the AX-400G vital sign simulator to the bedside monitor and check the accuracy of the temperature with the MULTI and TEMP sockets. After the check, return the setting to your setting used at your facility.

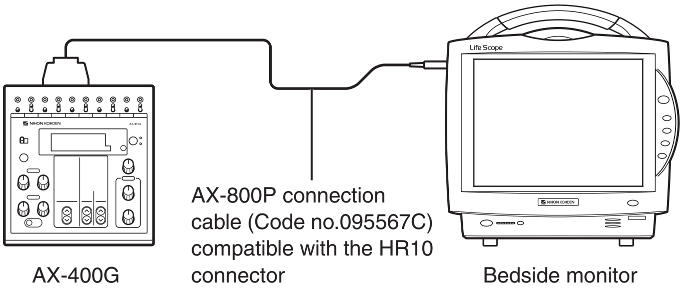
Preparations

Connection and Required Cable

Connect the AX-400G vital sign simulator to the bedside monitor.

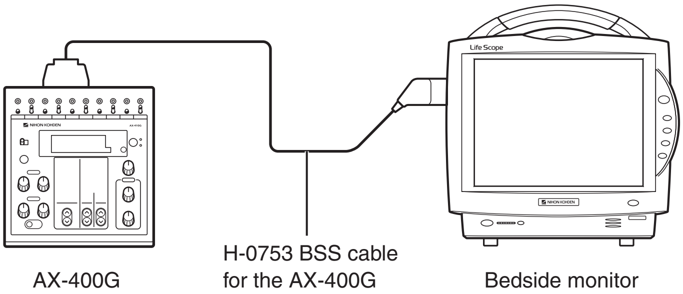
To the TEMP socket

Use the AX-800P connection cable which is compatible with the HR10 connector.


AX-400G
AX-800P connection cable (Code no.095567C) compatible with the HR10 connector
Bedside monitor
Life Scope

To the MULTI socket

Use the H-0753 BSS cable for the AX-400G.


AX-400G
H-0753 BSS cable for the AX-400G
Bedside monitor
Life Scope

Check the Accuracy of Temperature

Set the temperature output from the AX-400G vital sign simulator and make sure that the temperature shown on the instrument is within the accuracy range shown in the table below.

Setting on the AX-400G	Indication on the Bedside Monitor
25°C	24.8 to 25.2°C
37°C	36.8 to 37.2°C
44°C	43.8 to 44.2°C

Checking the Connector-Off Detection

Make sure that the connector-off is detected. While the temperature signal from the AX-400G vital sign simulator is being input, disconnect the temperature connection cord from the MULTI socket. Make sure that monitor operates as follows.

Alarm	Operation of the Bedside Monitor
Message display	The “TEMP CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

Checking the Sensor-Off Detection

Make sure that the sensor-off is detected. While the temperature signal from the AX-400G vital sign simulator is being input, remove the temperature cable plug from the TEMP socket. Make sure that monitor operates as follows.

Alarm	Operation of the Bedside Monitor
Message display	The “TEMP CHECK SENSOR” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

Checking the CO_2 Value

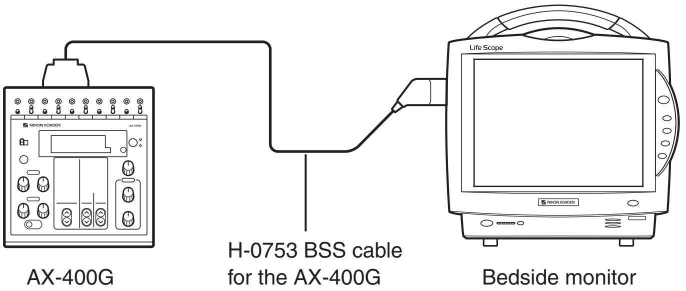
Connect the AX-400G vital sign simulator to the bedside monitor and check the CO_2 value and alarm with all MULTI sockets. Additionally, check the accuracy of the CO_2 sensor kit, as required.

After the check, return the current settings to your own settings.

Preparation

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.



Checking the Accuracy of the Respiration Rate and the CO_2 Value

Check that the respiration rate displayed on the bedside monitor is between 18 and 22 count/min and that the CO_2 value is between 40 and 46 mmHg.

Checking the Detection of an Connector-Off Alarm

Check that the connector-off alarm is normally generated. While the CO_2 signal is being entered from the AX-400G vital sign simulator, remove the connector for the CO_2 sensor kit from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The "CO_2 CONNECTOR OFF" message appears.
Alarm sound	The caution alarm's sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

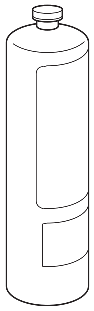
Checking the Measurement Accuracy of the CO_2 Sensor Kit

If the CO_2 measurement involves significant error, use the gas for sensitivity calibration to check the accuracy. To obtain stable measurement accuracy, perform the accuracy check regularly every six months.

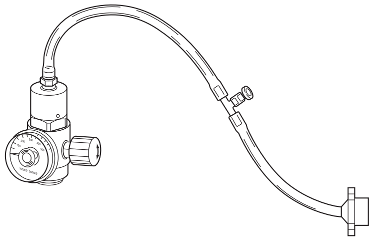
Preparations

Only use the gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden to check the accuracy. Also, prepare a CO_2 sensor kit and airway adapter.

<Gas cylinder for sensitivity calibration>
CO_2 5% sensitivity gas A-4



<Flow regulator>
PR-150



CAUTION

Follow the CAUTION label on the CO_2 gas cylinder.

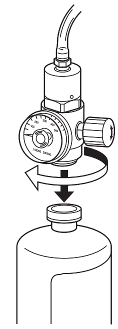
NOTE

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO_2 cylinders with the following specifications.
  Manufacturer: Nellcor Puritan Bennett, Scott Medical Products division of Air Liquide Healthcare, or other
  Outlet fitting: CGA 600
  Gas component: 5% CO_2, 21% O_2 and N_2 mix
  Expiration: 3 years after the gas is packed in the cylinder
  Accuracy: ±0.03% absolute

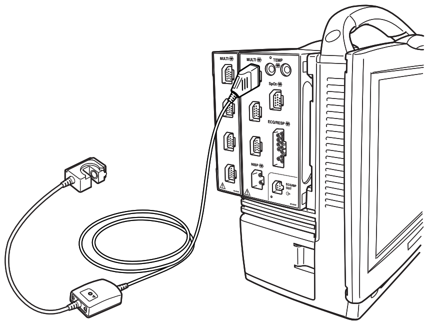
If the above CO_2 cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

- The gas cylinder for sensitivity calibration has its expiration date. Using the gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE) which is shown on the gas cylinder.
- Only use the PR-150 in which the pressure meter has a full scale of 700 psi. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

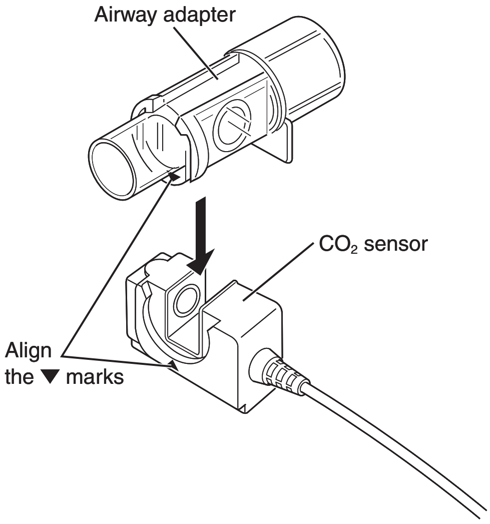
Checking the Accuracy of the TG-900P



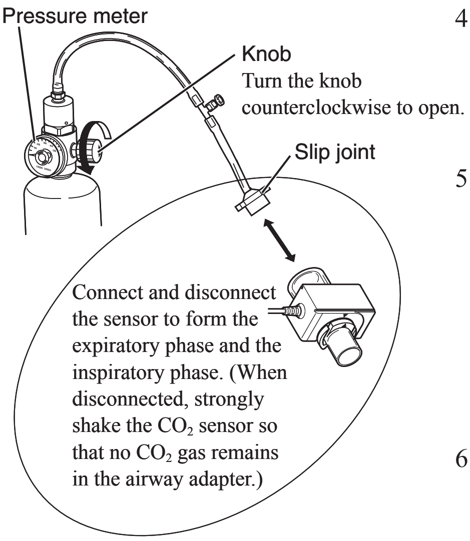
1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.



2. Connect the CO_2 sensor kit to the MULTI socket.



3. Connect the airway adapter to the CO_2 sensor.


Pressure meter
Knob
Turn the knob counterclockwise to open.
Slip joint
Connect and disconnect the sensor to form the expiratory phase and the inspiratory phase. (When disconnected, strongly shake the CO_2 sensor so that no CO_2 gas remains in the airway adapter.)

4. Let the CO_2 gas flow.
   Turn the knob of the flow regulator counterclockwise by about a half turn to let the CO_2 gas flow. Turn the knob slowly.

5. Form the expiratory and inspiratory phases and display the value of the CO_2 partial pressure (preparation).
   i) Connect the slip joint and the air adapter (expiratory phase).
   ii) Disconnect the air adapter from the slip joint section (inspiratory phase).
   iii) Repeat steps i) and ii) three times to display the value of the CO_2 partial pressure.

6. Check the accuracy.
   i) Connect the slip joint and the air adapter (expiratory phase).
   Check that the value of the CO_2 partial pressure displayed on the screen is between 34 and 42 mmHg. (See the “Supplementary” information on the next page.)
   ii) Disconnect the air adapter from the slip joint section (inspiratory phase).
   Check that 0 mmHg is read in the CO_2 display area on the monitor.
   iii) Repeat steps i) and ii) to check the accuracy.

NOTE

Measuring the CO_2 value in the TG-900P is based on the inspiratory compensation method; therefore, the CO_2 condensation in inspiratory mode should be calibrated to 0 mmHg. After the CO_2 gas equivalent to expiratory air is made to flow and the airway adapter is removed from the slip joint, strongly shake the CO_2 sensor so that no CO_2 gas remains (that is, the CO_2 gas in the airway adapter shows a reading of 0 mmHg), with the result that the existing CO_2 gas is completely replaced.

7. After checking the measurement accuracy, firmly turn the knob of the flow regulator clockwise to stop the CO_2 gas.

NOTE

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

Supplementary

- The TG-900P is calibrated at a temperature of 37°C in exhaled gas; therefore, the indication will show a change of approximately –0.4%/°C at any other temperature. Generally, the gas to be calibrated is low in temperature and it might indicate a pressure of 40 mmHg.
- With the TG-900P, the unit of 1 atm is used for calibration. The indication will change at a rate of 1 mmHg/30 hPa in an environment of other than 1 atm.

Example 1: Checking the accuracy at high air pressure

Condensation of CO_2 calibration gas: 38 mmHg (5%); atmospheric pressure: an increase of 60 hPa

The measurement is higher by the amount of 1 mm Hg × (60hPa / 30hPa) = 2 mmHg.

Therefore, 40 mmHg is indicated.

Example 2: Checking the accuracy at a high altitude

Condensation of CO_2 calibration gas: 38 mmHg (5%); altitude: 1,000 m

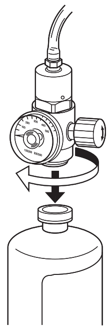
Change in atmospheric pressure = 1013 hPa × 0.1 (altitude-based rate of change in atmospheric pressure) = 101.3 hPa

101.3 hPa / 30 hPa = 3.4 mmHg

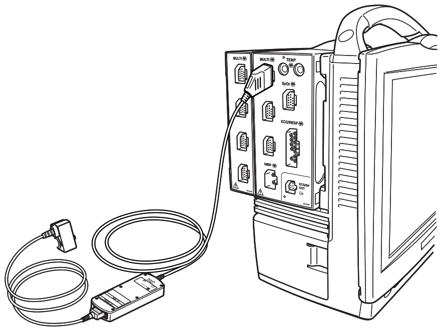
38 mmHg – 3.4 mmHg = 34.6 mmHg

Therefore, 34.6 mmHg is indicated.

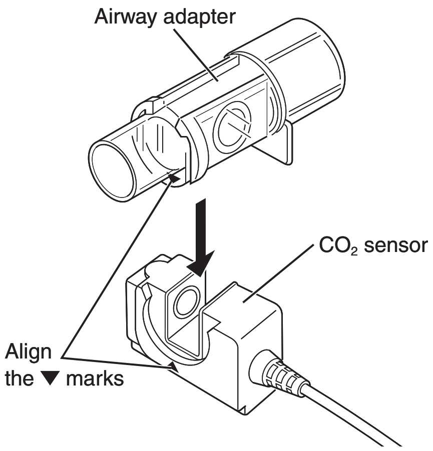
Checking the Accuracy of the TG-950P/970P



1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.

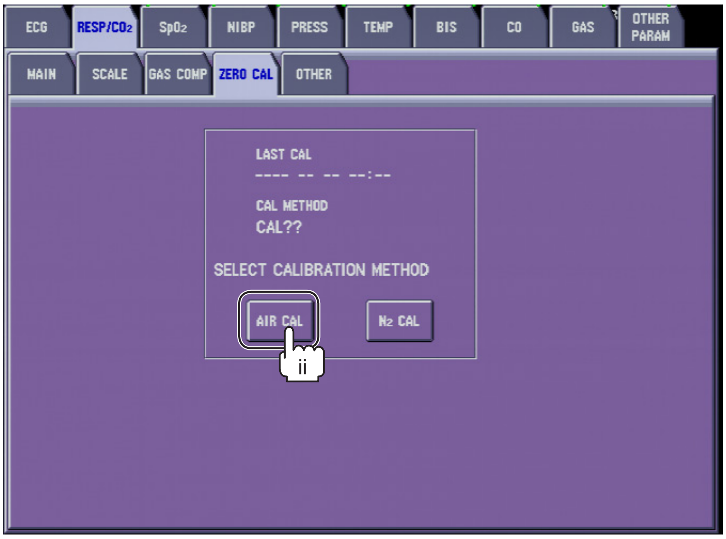


2. Connect the CO_2 sensor kit to the MULTI socket.



3. Connect the airway adapter to the CO_2 sensor.

4. Follow steps i) to iv) to perform zero calibration of the CO_2 sensor (Air calibration).
   i) Expose the airway adapter placed in the CO_2 sensor kit to room air.
   ii) Touch the RESP/CO_2 → ZERO CAL tab. Touch the AIR CAL key for the calibration method.

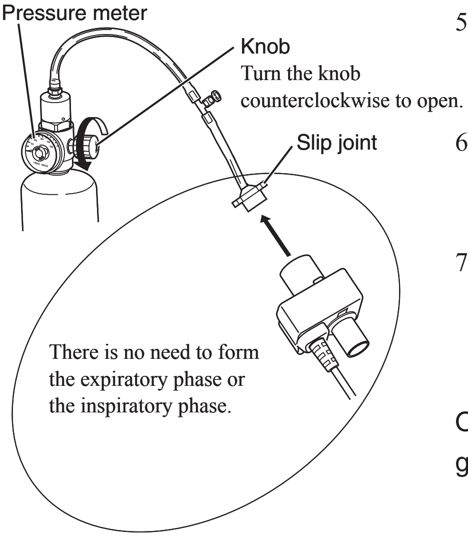

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
AIR CAL
N2 CAL
ii

LAST CAL
---- -- -- --:--

CAL METHOD
CAL??

SELECT CALIBRATION METHOD

   iii) When the “EXPOSE SENSOR TO AIR” message appears, touch YES to perform air calibration. While the calibration is being performed, the “CALIBRATING” message appears.
   iv) When the calibration is completed, the “CALIBRATION COMPLETE” message appears and the message is followed by the date of calibration and the method of calibration.


Pressure meter
Knob
Turn the knob counterclockwise to open.
Slip joint
There is no need to form the expiratory phase or the inspiratory phase.

5. Turn the knob of the flow regulator counterclockwise by about a half turn to let the CO_2 gas flow. Turn the knob slowly.

6. Connect the split joint and the airway adapter. Check that the value of the CO_2 partial pressure displayed on the screen is between 36 and 40 mmHg.

7. After checking the measurement accuracy, firmly turn the knob of the flow regulator clockwise to stop the gas.

NOTE

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

Supplementary

- The TG-950P/970P is calibrated at a temperature of 37°C in exhaled gas; therefore, the indication will show a change of approximately –0.4%/°C at any other temperature. Generally, the gas to be calibrated is low in temperature and it might indicate a pressure of 40 mmHg.
- When the TG-950P/970P is used, atmospheric compensation is already performed. There is no need to read the indication again.

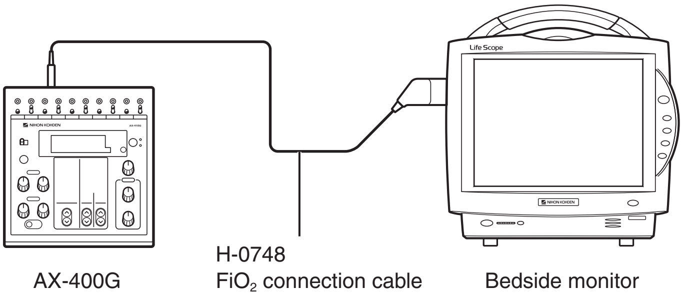
Checking the O_2 Value

Connect the AX-400G vital sign simulator to the bedside monitor and check zero calibration and the accuracy of the O_2 value. Additionally, check if the alarm works normally with all MULTI sockets. After the check, return the current settings to your own settings.

Preparation

Connection

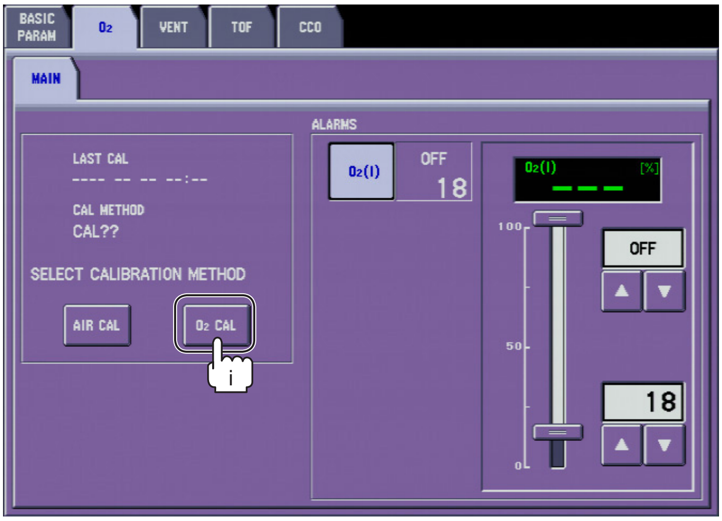
Connect the AX-400G vital sign simulator to the bedside monitor with the H-0748 FiO_2 connection cable.


AX-400G
H-0748
FiO₂ connection cable
Bedside monitor
Life Scope

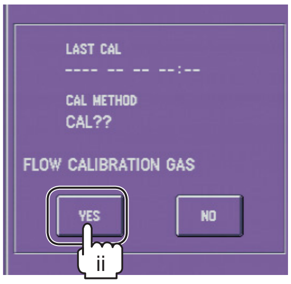
Checking the Accuracy of O_2 Calibration

1. Set the FiO_2 value of the AX-400G vital sign simulator to “100”.

2. Follow steps i) to iii) to perform O_2 calibration.
   i) Touch O_2 → MAIN. Touch the O_2 CAL key for the calibration method.


BASIC PARAM
O2
VENT
TOF
CCO
MAIN
ALARMS
O2(I)
OFF
18
O2(I)
[%]
100
50
0
OFF
▲ ▼
18
▲ ▼
AIR CAL
O2 CAL
i

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
SELECT CALIBRATION METHOD



LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
FLOW CALIBRATION GAS

   ii) When the “FLOW CALIBRATION GAS” message appears, touch YES to perform O_2 calibration. While the calibration is being performed, the “CALIBRATING” message appears.
   iii) When calibration is completed, the “CALIBRATION COMPLETE” message appears and the message is followed by the date of calibration and the method of calibration. Check that the displayed O_2 value is between 100 and 97%.

Checking the Accuracy of the O_2 Value

After performing the O_2 calibration, set the FiO_2 value produced from the AX-400G vital sign simulator in the following way and check that the O_2 value meets the requirement of the table below.

Setting on the AX-400G	Display on the Bedside Monitor
50%	48 to 52%
21%	19 to 23%

Checking the Detection of an Connector-Off Alarm

Check that the connector-off alarm is normally generated. While the FiO_2 signal is being entered from the AX-400G vital sign simulator, remove the connector for the FiO_2 cable from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The “O_2 CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

Checking the Cardiac Output

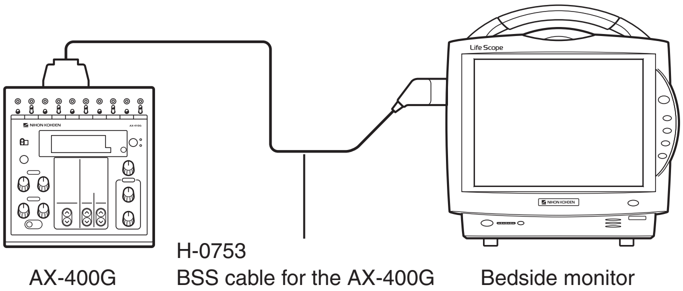
Connect the AX-400G vital sign simulator to the bedside monitor and check that blood temperature (Tb), injectate temperature (Ti) and cardiac output (CO) are normally displayed. Additionally, check if the alarm works normally with all MULTI sockets.

After the check, return the current settings to your own settings.

Preparation

Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.



Checking the Accuracy of the Blood Temperature (Tb) and Injectate Temperature (Ti)

When the AX-400G vital sign simulator is set to Tb = 37°C and Ti = 0°C, check that the Tb value displayed on the bedside monitor is between 36.8 and 37.2°C and that the Ti value is between –0.2 and +0.2 °C.

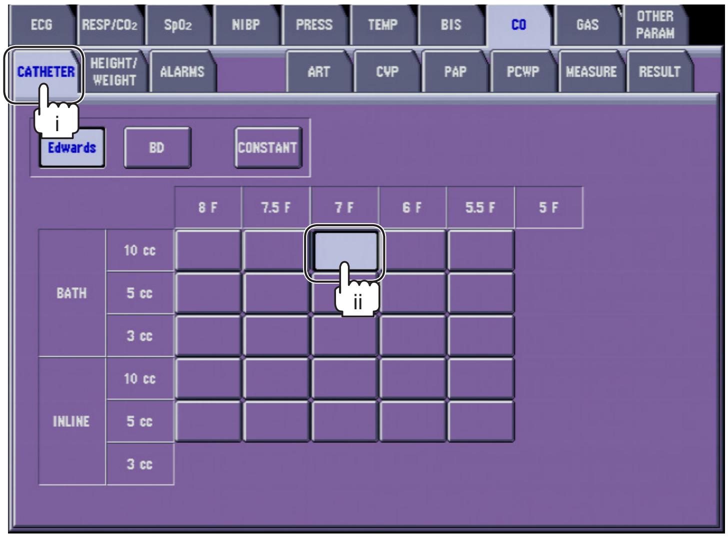
Checking the Accuracy of the Cardiac Output (CO)

1. Set the cardiac output window on the bedside monitor.

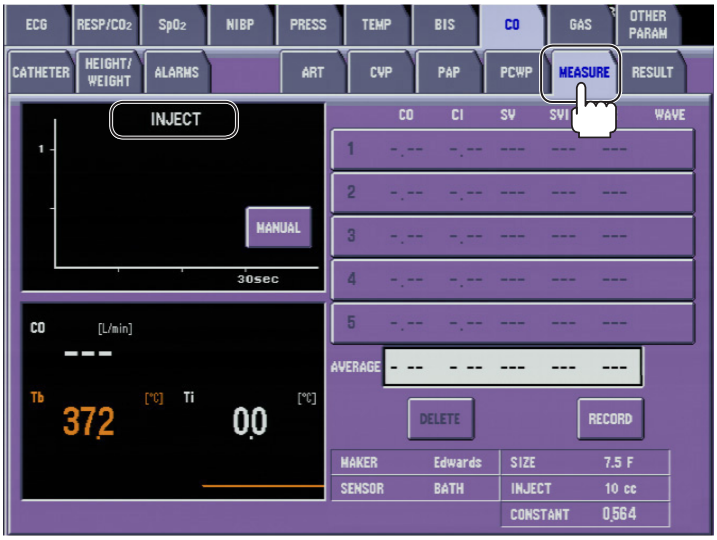
CO Window		Setting Item
CATHETER setting	**Method of measuring the injectate temperature**	Bus probe
	Size of the catheter	7 F
	Injectate amount	10 cc

i) Touch CO → CATHETER tab to display the CATHETER page.

ii) On the CATHETER page, touch the field in which the bus probe's 10 cc and 7 F intersect.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
i
Edwards
BD
CONSTANT
8 F
7.5 F
7 F
6 F
5.5 F
5 F
BATH
10 cc
5 cc
3 cc
INLINE
10 cc
5 cc
3 cc
ii

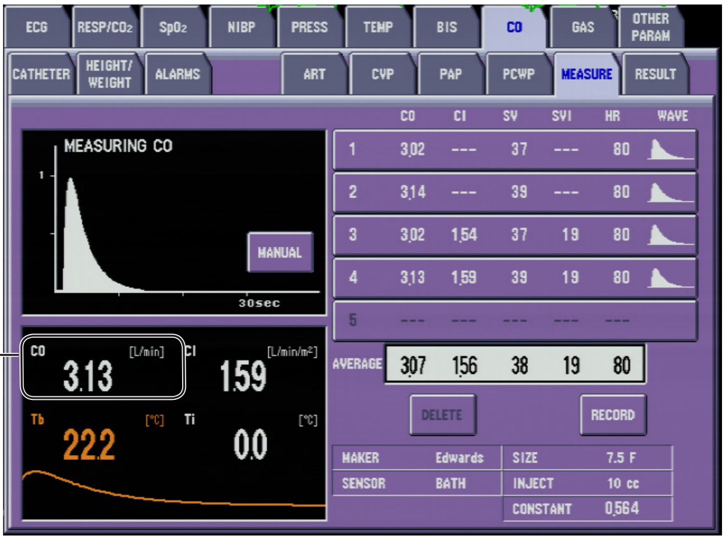
2. Touch the MEASURE tab to switch to the measurement window. When the "INJECT" message appears on the window, press the CO START key of the AX-400G vital sign simulator.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
INJECT
1
MANUAL
30sec
CO [L/min]

Tb [°C] 372
Ti [°C] 00
CO CI SV SVI WAVE
1
2
3
4
5
AVERAGE
DELETE
RECORD

MAKER Edwards
SENSOR BATH
SIZE 7.5 F
INJECT 10 cc
CONSTANT 0.564

3. Check that a thermodilution curve is drawn and that the value of the cardiac output (CO) is between 4.50 and 5.50.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
MEASURING CO
1
MANUAL
30sec
DELETE
RECORD

Cardiac output (CO) value

CO [L/min] 3.13 CI [L/min/m²] 1.59
Tb [°C] 22.2 Ti [°C] 0.0

	CO	CI	SV	SVI	HR	WAVE
1	3.02	---	37	---	80	
2	3.14	---	39	---	80	
3	3.02	1.54	37	19	80	
4	3.13	1.59	39	19	80	
5	---	---	---	---	---	
AVERAGE	3.07	1.56	38	19	80	

MAKER	Edwards	SIZE	7.5 F
SENSOR	BATH	INJECT	10 cc
		CONSTANT	0.564

Checking the Detection of a Connector-Off Alarm

Check that the connector-off alarm is normally generated. Remove the connector of the CO cable from the bedside monitor and check that the bedside monitor works in the following way.

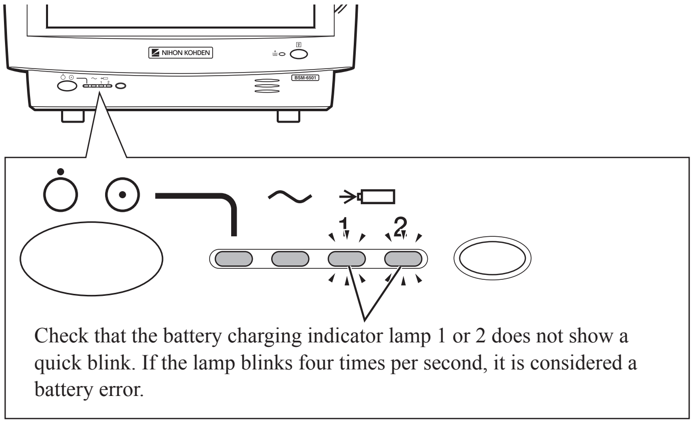
Alarm	Operation of the Bedside Monitor
Message display	The “CO CONNECTOR OFF” message appears.
Alarm sound	The caution alarm sounds.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

Checking Battery Operation

When the optional SB-671P battery pack is already set, check that the bedside monitor is correct in battery operation.

1. Remove the power cord and check that the bedside monitor continues operating.

2. Connect the power cord and check that the battery charging indicator lamp 1 or 2 does not show a quick blink. If the lamp blinks four times per second, it is considered a battery error.



Check that the battery charging indicator lamp 1 or 2 does not show a quick blink. If the lamp blinks four times per second, it is considered a battery error.

ZS-900P Transmitter

Availability of Service Parts

The period during which Nihon Kohden is responsible for the maintenance and repair of the ZS-900P transmitter is eight years after delivery. Note that repair parts for the transmitter (the parts required to maintain the product’s functionality) are available for at least eight years after discontinuation of the transmitter. The period during which these parts are available is also the period during which repair is available.

The parts availability period might be less depending on when you purchased the product. Even after the parts availability period is over, some parts might be repairable.

Checking the Appearance for Damage and Dirt

Check the following items.

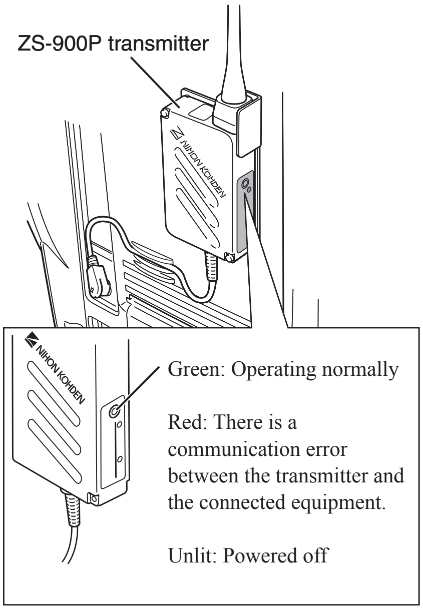
- All parts of the monitor are free of dirt.
- The exterior of the monitor is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The labels are not come off or be torn off.
- The connectors can be connected and disconnected normally.
- The connectors and connection cables are not cracked or loose.

Checking the State of Operation

Check the transmitter for its state of operation.

1. Check that the transmitter is already connected to the bedside monitor.

2. Turn on the bedside monitor and check that the LED on the transmitter lights green.



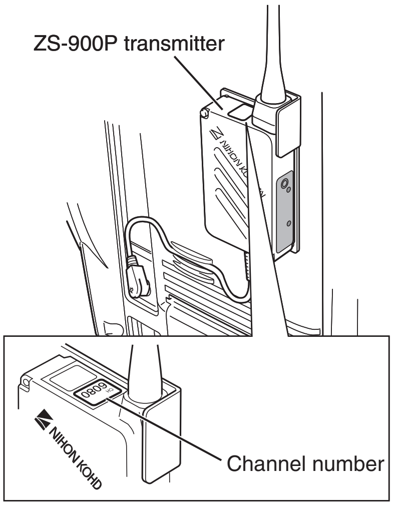
Green: Operating normally

Red: There is a communication error between the transmitter and the connected equipment.

Unlit: Powered off

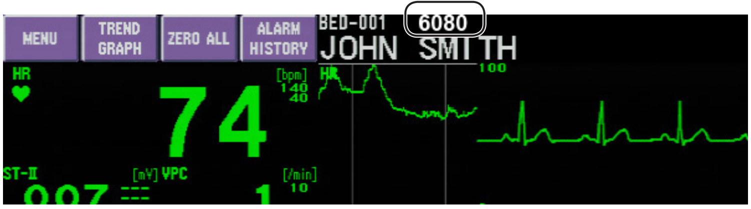
Checking the State of Transmission

Check that information from the transmitter is normally transmitted to the receiving monitor.


ZS-900P transmitter
NIHON KOHDEN
6080
Channel number

1. Check that the channel number attached to the transmitter is the same as the channel number displayed on the bedside monitor’s home screen.

The channel number specified for the transmitter appears.

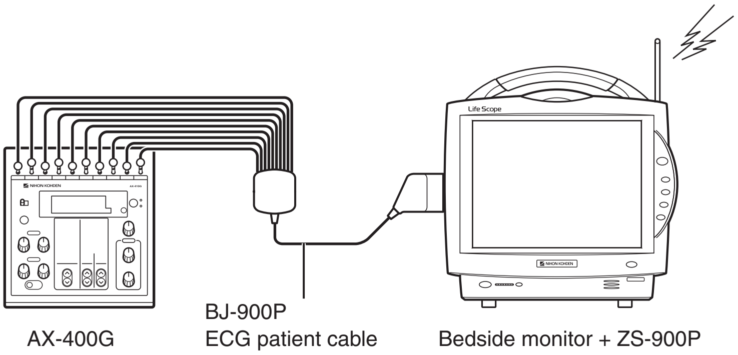

MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
6080
JOHN SMITH
HR
[bpm]
140
40
74
HR
ST-II
[mV]
VPC
[/min]
10

2. Place the receiving monitor by a visible distance of 2 to 3 m apart from the bedside monitor.

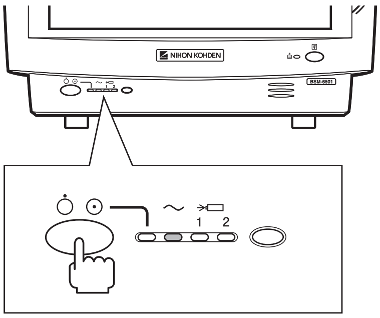
3. Turn on the receiving monitor and set the receiving channel to the transmitter’s channel.

4. Connect the AX-400G vital sign simulator to the bedside monitor and turn on each of the power supplies.

<Example: When the BJ-900P ECG patient cable is used>


Life Scope
AX-400G
BJ-900P
ECG patient cable
Bedside monitor + ZS-900P

5. On the receiving monitor, check that the ECG and heart rate are normally received.


NIHON KOHDEN
BSM-6001
1
2

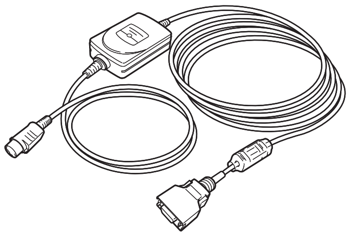
6. Press the [Power] switch on the front of the bedside monitor to turn off the bedside monitor.

7. Check that the ECG displayed on the receiving monitor shows triangle waveform.

QF Series Interface/IF Series Communication Cable

Check the QF series interface (QF-901P, QF-902P, QF-903P, QF-904P, QF-905P, QF-907P, QF-908P, QF-909P, QF-911P or QF-921P) or IF series communication cable (IF-917P, IF-920P, IF-922P or IF-923P).

Checking the Appearance for Damage and Dirt



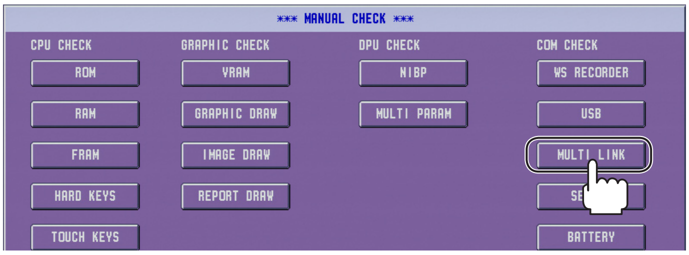
Check the following items.

- The exterior of the QF series interface or IF series communication cable is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The labels are not come off or torn off.
- The connectors can be connected and disconnected normally.

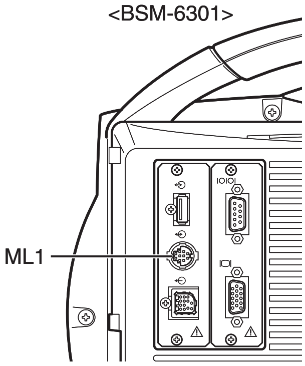
Checking the Connection

Check the state of connection between the QF series interface or IF series communication cable and the bedside monitor.

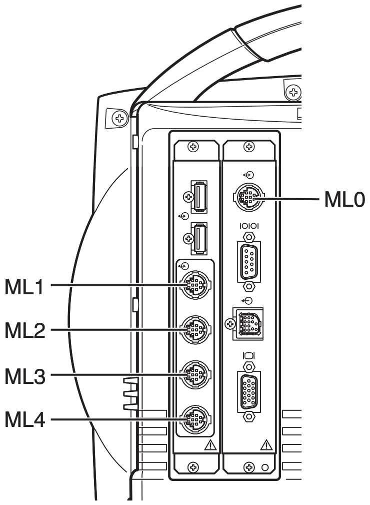
1. On the MANUAL CHECK screen, touch the MULTI LINK key to display the MULTI LINK CHECK screen.


*** MANUAL CHECK ***
CPU CHECK
ROM
RAM
FRAM
HARD KEYS
TOUCH KEYS
GRAPHIC CHECK
VRAM
GRAPHIC DRAW
IMAGE DRAW
REPORT DRAW
DPU CHECK
NIBP
MULTI PARAM
COM CHECK
WS RECORDER
USB
MULTI LINK
SE
BATTERY

<BSM-6301>

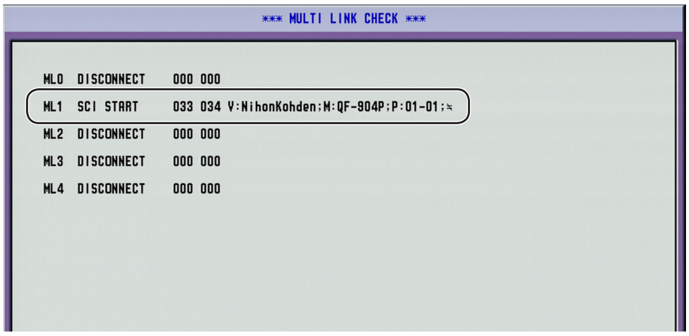


<BSM-6501/6701>


ML0
ML1
ML2
ML3
ML4

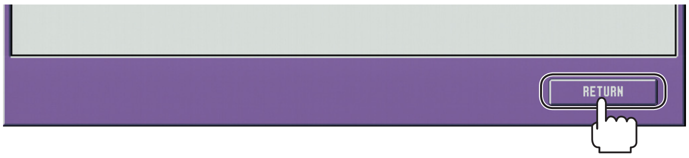
2. Check the state of communication.
   i) Connect the QF series interface or IF series communication cable to be checked to the multi-link sockets (BSM-6301: ML1 or ML1 to ML3; BSM-6501 and BSM-6701: ML0 to ML4) at the rear of the bedside monitor.
   ii) Check that the information about the connected QF series interface or IF series communication cable appears on the MULTI LINK CHECK screen.

<Example: When the QF-904P is connected to ML1 of the BSM-6501>

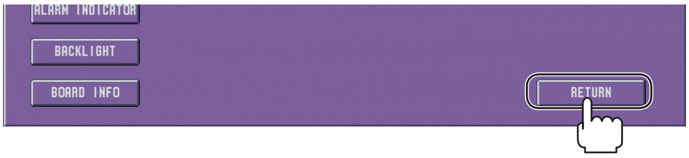


```
*** MULTI LINK CHECK ***

ML0  DISCONNECT    000 000
ML1  SCI START     033 034 V:NihonKohden;M:QF-904P;P:01-01;≒
ML2  DISCONNECT    000 000
ML3  DISCONNECT    000 000
ML4  DISCONNECT    000 000
```

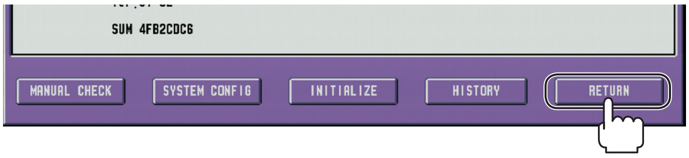
3. Touch the RETURN key to return to the MANUAL CHECK screen.



4. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.


ALARM INDICATOR
BACKLIGHT
BOARD INFO
RETURN

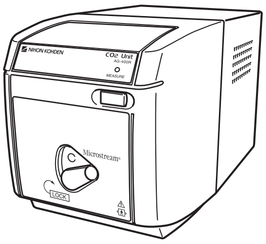
5. On the DIAGNOSTIC CHECK screen, touch the RETURN key to return to the home screen.


SUM 4FB2CDC6

MANUAL CHECK
SYSTEM CONFIG
INITIALIZE
HISTORY
RETURN

AG-400R CO_2 Unit

Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the CO_2 unit is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the QF-905P interface.

Checking the Accuracy of the O_2 Value

Timing of Accuracy Check And Sensitivity Calibration

CAUTION

When the monitoring value is not appropriate, perform gas calibration. Perform gas calibration every six months for stable measuring accuracy.

NOTE

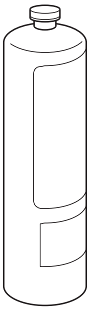
Turn on the MEASURE switch of the CO_2 unit and connect the filter line and wait at least 20 minutes to perform accuracy check and sensitivity calibration.

Preparation

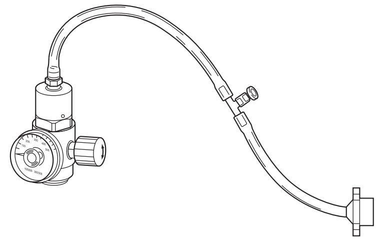
Cabling required
- Filter line
- Airway adapter

Only use the specified gas cylinder for sensitivity calibration and flow regulator to check the accuracy. Also, prepare a filter line and airway adapter.

<Gas cylinder for sensitivity calibration>
CO_2 5% sensitivity gas A-4



<Flow regulator>
PR-150



CAUTION

Follow the CAUTION label on the CO_2 gas cylinder.

NOTE

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO_2 cylinders with the following specifications.

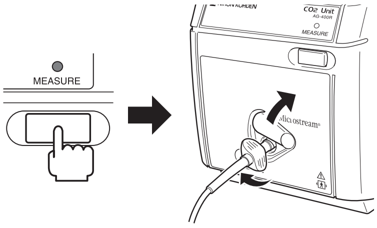
Manufacturer:	Nellcor Puritan Bennett, Scott Medical Products division of Air Liquide Healthcare, or other
Outlet fitting:	CGA 600

Gas component: 5% CO_2, 21% O_2 and N_2 mix
Expiration: 3 years after the gas is packed in the cylinder
Accuracy: ±0.03% absolute

If the above CO_2 cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

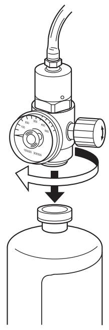
- The gas cylinder for sensitivity calibration has its expiration date. Using a gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE), which is shown on the gas cylinder.
- Only use the flow regulator in which the pressure meter has a full scale of 700 psi. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

Performing Accuracy Check and Sensitivity Calibration

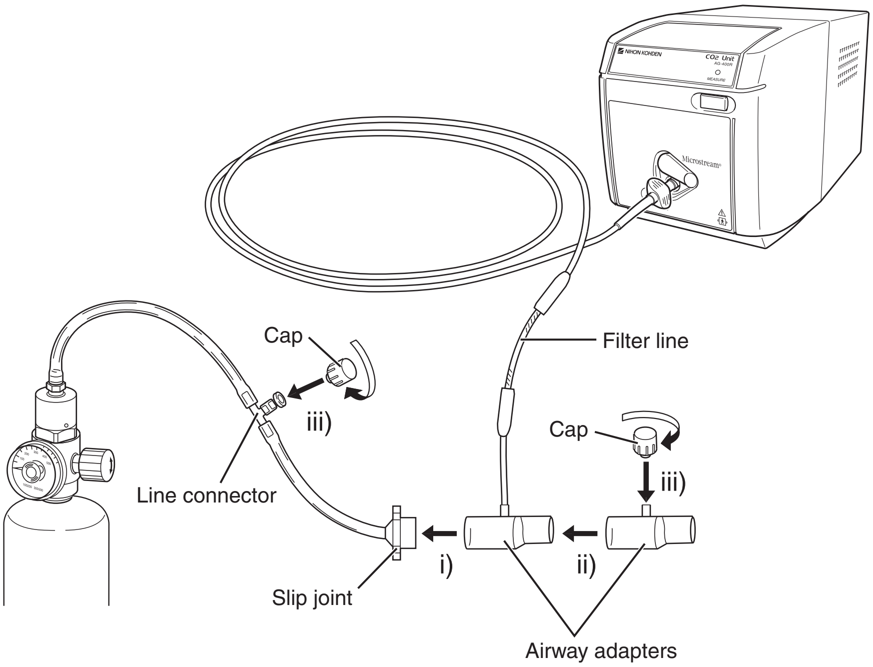


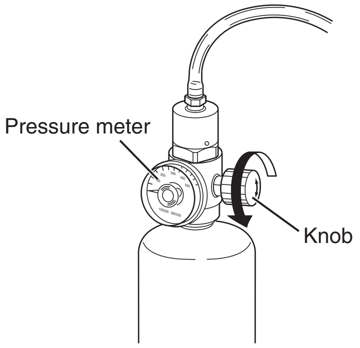
NOTE

Turn on the MEASURE switch of the CO_2 unit and connect the filter line and wait at least 20 minutes to perform accuracy check and sensitivity calibration.



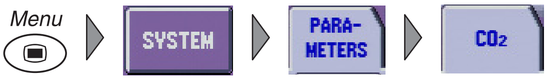
1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.
2. Connect the filter line.
   i) Connect the split joint and the airway adapter.
   ii) Connect another airway adapter to the filter line’s airway adapter.
   iii) Cap the regulator’s luer connector and the airway adapter.


Cap
iii)
Filter line
Cap
iii)
Line connector
i)
ii)
Slip joint
Airway adapters


Pressure meter
Knob

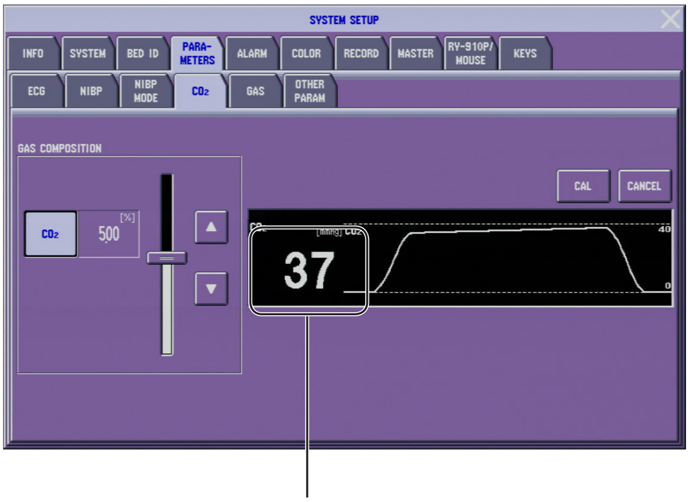
3. After checking that the connection of a gas cylinder and others is firm, turn the knob of the flow regulator counterclockwise by about a half turn to let the calibration gas flow. Turn the knob slowly.

4. Display the CO_2 page of the PARAMETER window.
   Press [Menu] key → SYSTEM key → enter the password → PARAMETERS tab → CO_2 tab.


Menu
SYSTEM
PARA-
METERS
CO2

5. Check that the value of the instantaneous CO_2 partial pressure displayed on the CO_2 page meets the following accuracy range.

Gas for Sensitivity Calibration		**Displayed Instantaneous CO_2 Partial Pressure (Error)**
CO_2	**5%**	Atmospheric pressure × 0.05 mmHg (±2 mmHg)


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
ECG
NIBP
NIBP MODE
CO2
GAS
OTHER PARAM
GAS COMPOSITION
CO2
[%]
500
CAL
CANCEL
CO2
[mmHg] CO2
37
40
0

Instantaneous CO_2 partial pressure

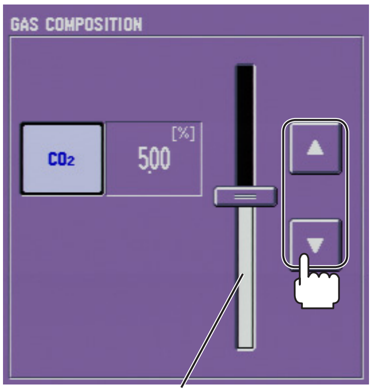
6. After accuracy check is completed, firmly turn the knob of the flow regulator clockwise to stop the gas.

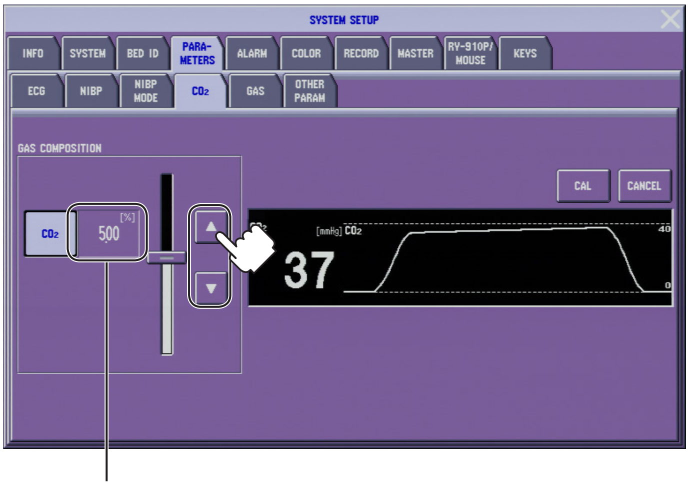
NOTE

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

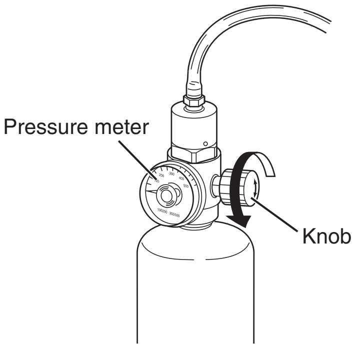
If the above measurement accuracy is not met, follow steps 7 to 11 to perform sensitivity calibration.

7. On the CO_2 page, check to see if the value of the CO_2 condensation displayed in the GAS COMPOSITION matches the CO_2 condensation of the calibration gas to be used. If it does not match, set the value by sliding the setting bar vertically or touching ▲ and ▼.


GAS COMPOSITION
CO2
[%]
500
Setting bar


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
ECG
NIBP
NIBP MODE
CO2
GAS
OTHER PARAM
GAS COMPOSITION
CO2
[%]
500
CAL
CANCEL
CO2
[mmHg] CO2
37
40
0

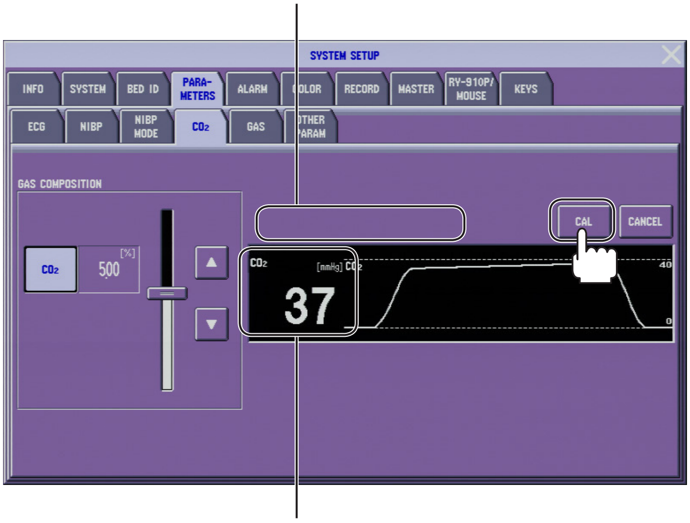
The CO_2 condensation of the calibration gas should be matched.


Pressure meter
Knob

8. After checking that the connection of a gas cylinder and others is firm, turn the knob of the flow regulator counterclockwise by about a half turn to let the CO_2 gas flow. Turn the knob slowly.

9. Check that the measurement is stable and touch the CAL key. While calibration is in progress, the “CO_2 ZERO CALIBRATING” message appears. You can stop the calibration by touching the CANCEL key.

This area displays one of the following messages “CALIBRATING” “PLEASE WAIT” and “CALIBRATION COMPLETED.”


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
ECG
NIBP
NIBP MODE
CO2
GAS
OTHER PARAM
GAS COMPOSITION
CO2
[%]
500
CAL
CANCEL
CO2
[mmHg]
CO2
37
40
0

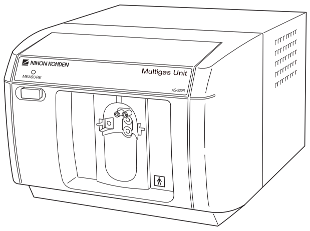
Check that the measurement is stable.

10. If the “CO_2 PLEASE WAIT” message appears, turn the flow regulator’s knob fully clockwise to stop the gas.

11. When the sensitivity calibration is completed, the “CO_2 CAL COMPLETE” message appears. The message is displayed for several seconds and disappears automatically.

AG-920R Multigas Unit

Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the multi-gas unit is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the QF-904P interface.

Checking the Accuracy of Anesthesia Gas

Timing of Accuracy Check and Sensitivity Calibration

CAUTION

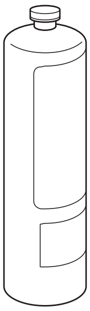
When the monitoring value is not appropriate, perform gas calibration. Perform gas calibration once a year for stable measuring accuracy.

Preparations

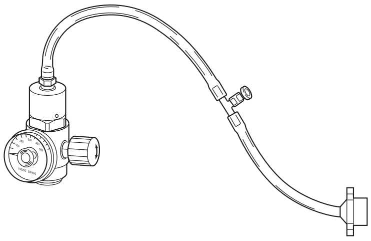
Cabling required
- Adult water trap
- Adult sampling line

Only use the gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden to check the accuracy and to perform sensitivity calibration. Perform the sensitivity calibration of CO_2, O_2, N_2O and AGENT values simultaneously.

<Gas cylinder for sensitivity calibration>
for the multi-gas unit A-5



<Flow regulator>
PR-150P 250 mL/min



A single gas cylinder lets gas flow for approximately 10 minutes (requiring one minute for a single cycle of calibration allows you to perform about 10 cycles of calibration).

CAUTION

Follow the CAUTION label on the CO_2 gas cylinder.

NOTE

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO_2 cylinders with the following specifications.

Manufacturer: Nellcor Puritan Bennett, Scott Medical Products division of Air Liquide Healthcare, or other
Outlet fitting: CGA 600
Gas component: 3% isoflurane, 5% CO$_2$, 40% N$_2$O and 52% BalO$_2$
Expiration: 3 years after the gas is packed in the cylinder
Accuracy: ±0.03% absolute

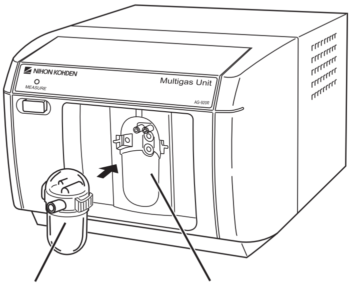
If the above CO$_2$ cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

- The gas cylinder for sensitivity calibration has its expiration date. Using a gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE), which is shown on the gas cylinder.
- Only use the PR-150P flow regulator in which the pressure meter has a full scale of 0.6 Mpa. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

Methods of Accuracy Check

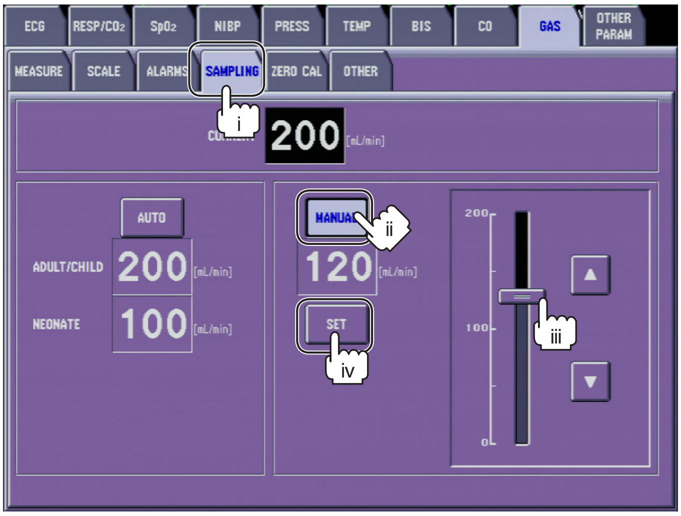
NOTE

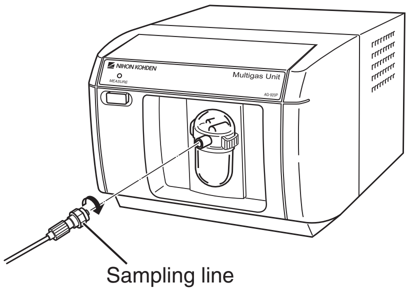
After the power supply is turned on, wait for at least 1 hour to perform accuracy check and sensitivity calibration.


NIHON KOHDEN
Multigas Unit
MEASURE
Adult water trap
Water trap receptacle

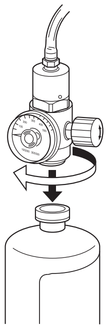
1. Attach the adult water trap to the water trap receptacle of the multi-gas unit.

2. On the SAMPLING page of the bedside monitor, set the sampling flow to 120 mL/min in MANUAL.
   - i) Touch the SAMPLING tab to display the SAMPLING page.
   - ii) Touch the MANUAL key.
   - iii) Slide the setting bar vertically and set the flow rate to “120”. You can fine-adjust the setting by touching ▲ or ▼.
   - iv) Touch the SET key to determine the value.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
ZERO CAL
OTHER
CURRENT 200 [mL/min]
AUTO
ADULT/CHILD 200 [mL/min]
NEONATE 100 [mL/min]
MANUAL
120 [mL/min]
SET
200
100
0
▲
▼
i
ii
iii
iv


NIHON KOHDEN
Multigas Unit
Sampling line

3. Attach the adult sampling line to the adult water trap attached to the multi-gas unit.

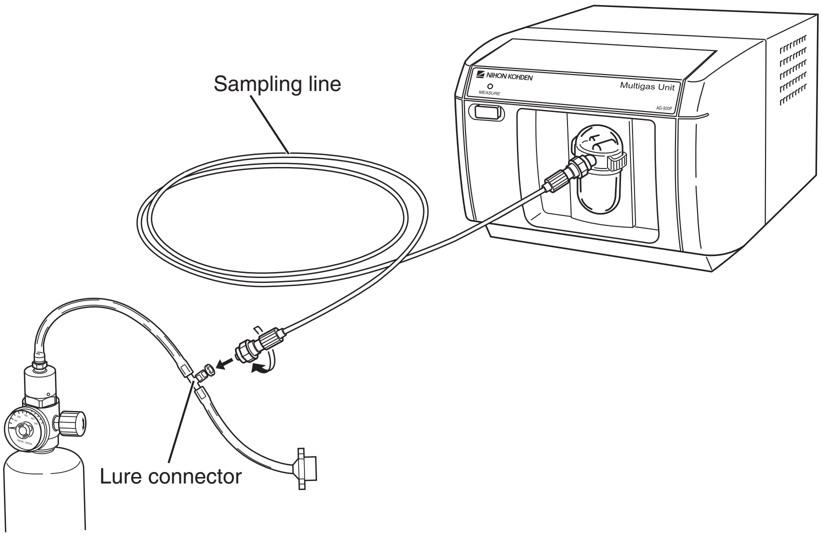


4. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.

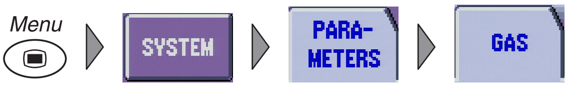
5. Turn the sampling line (male) clockwise to connect it to the luer connector of the flow regulator.

NOTE

- Be sure that the unit is not exposed to direct pressure.
- Do not block the exit to the flow regulator.
- The gas leading to the unit must always be under atmospheric pressure.

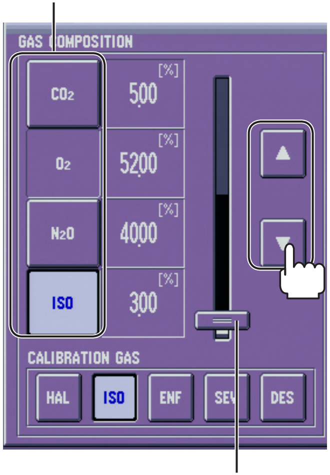

Sampling line
NIHON KOHDEN
Multigas Unit
Lure connector

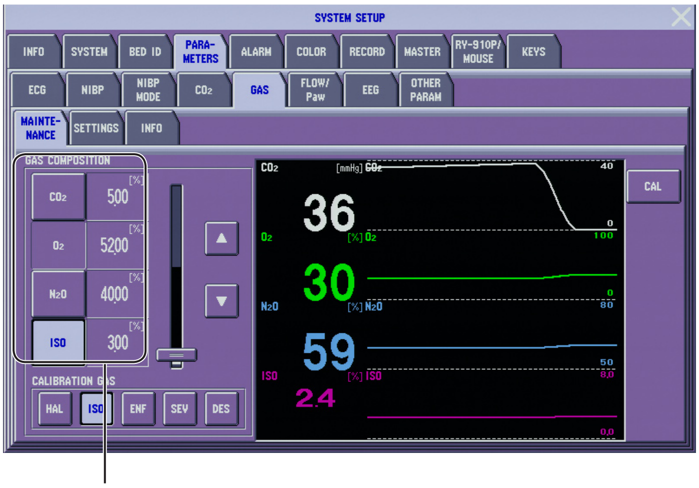
6. Display the GAS page in the SYSTEM SETUP screen.
   Press the [Menu] key and touch the SYSTEM key → PARAMETERS tab → GAS tab.


Menu
SYSTEM
PARA-
METERS
GAS

7. Check if the value of condensation displayed in <GAS COMPOSITION> of the GAS page matches the condensation of each gas described on the gas cylinder for sensitivity calibration to be used. If not, set the value by selecting any non-matching item and sliding the setting bar vertically or touching ▲ and ▼.

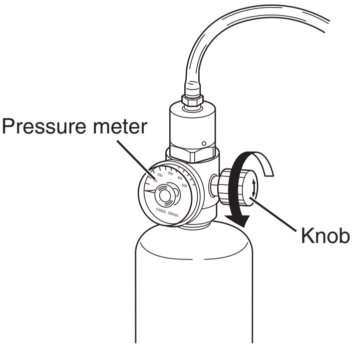
Select any non-matching items.


GAS COMPOSITION
CO2 [%] 500
O2 [%] 5200
N2O [%] 4000
ISO [%] 300
CALIBRATION GAS
HAL
ISO
ENF
SEV
DES
Setting bar


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910P/MOUSE
KEYS
ECG
NIBP
NIBP MODE
CO2
GAS
FLOW/Paw
EEG
OTHER PARAM
MAINTE-NANCE
SETTINGS
INFO
GAS COMPOSITION
CO2 [%] 500
O2 [%] 5200
N2O [%] 4000
ISO [%] 300
CALIBRATION GAS
HAL
ISO
ENF
SEV
DES
CO2 [mmHg] CO2 40 0
36
O2 [%] O2 100 0
30
N2O [%] N2O 80
59 50
ISO [%] ISO 8.0
2.4 0.0
CAL

The condensation of the calibration gas should be matched.

8. Turn the knob of the flow regulator counterclockwise by about a half turn to let the calibration gas flow. Turn the knob slowly.


Pressure meter
Knob

NOTE

Before letting the calibration gas flow, check that the reading of the flow regulator's pressure meter is at least 0.1 Mpa. If the reading of 0.1 Mpa is not reached, replace the gas cylinder for sensitivity calibration with a new one. This is because correct sensitivity calibration fails if the remaining pressure of the gas cylinder is too low.

9. In approximately 30 seconds after flowing the calibration gas, check that the measurement is stable and that the measured value of each gas meets the requirement of the table below.

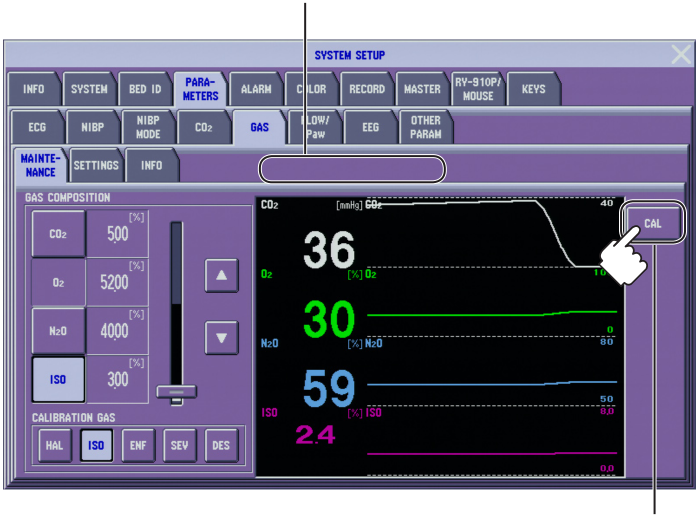
Gas for sensitivity calibration		**Display on the bedside monitor (Error)**
CO_2	**5 %**	Atmospheric pressure × 0.05 mmHg (±2 mmHg)
O_2	**52 %**	50 to 54 % (52 ± 2%)
N_2O	**40 %**	37 to 43 % (40 ± 3%)
ISO	**3 %**	2.8 to 3.2 % (3.0 ± 0.2 %)

If the above measurement accuracy is not met, follow steps 10 to 13 to perform sensitivity calibration.

Method of Sensitivity Calibration

1. In approximately 30 seconds after the calibration gas is caused to flow, check that the measurement is stable and touch the CAL key. While calibration is in progress, the “CALIBRATING” message appears.

This area displays the “CALIBRATING” message.


SYSTEM SETUP
INFO
SYSTEM
BED ID
PARA-METERS
ALARM
COLOR
RECORD
MASTER
RY-910PA MOUSE
KEYS
ECG
NIBP
NIBP MODE
CO2
GAS
FLOW/Paw
EEG
OTHER PARAM
MAINTE-NANCE
SETTINGS
INFO
GAS COMPOSITION
CO2 500 [%]
O2 5200 [%]
N2O 4000 [%]
ISO 300 [%]
CALIBRATION GAS
HAL
ISO
ENF
SEV
DES
CO2 [mmHg] CO2 40 36 10
O2 30 [%] O2 0 80
N2O 59 [%] N2O 50 0.0
ISO 2.4 [%] ISO 0.0
CAL

Touching is not possible if the gas described on the gas cylinder is not different from the gas name displayed on the screen or if the measurement is not stable.

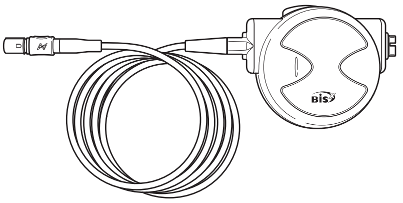
2. When the calibration is completed, the “CALIBRATING” message disappears.

3. Turn the flow regulator’s knob fully clockwise to stop the gas.

4. By referring to step 2, turn the sampling flow of the bedside monitor to the state before calibration.

QE-910P BIS Processor

Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the BIS processor is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the connection cable.

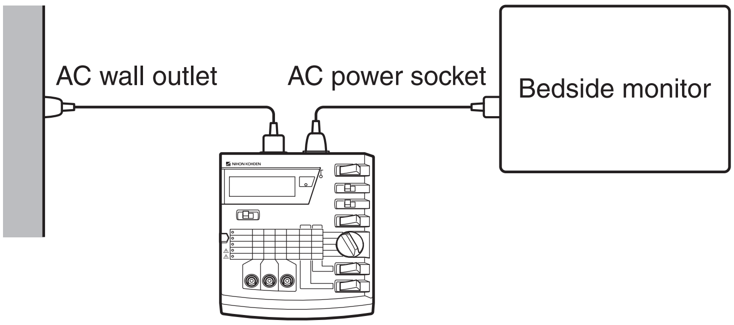
Safety Check

Safety check is performed while the components are connected. You need to measure four different currents (earth leakage current, enclosure leakage current, patient leakage current and patient auxiliary current) in both the normal condition and a single-fault condition to make sure that the allowable value is not exceeded. You also need to record the measured values.

NOTE

Performing safety inspection requires a special instrument for measuring leak currents.

<Example of measuring earth leakage current>

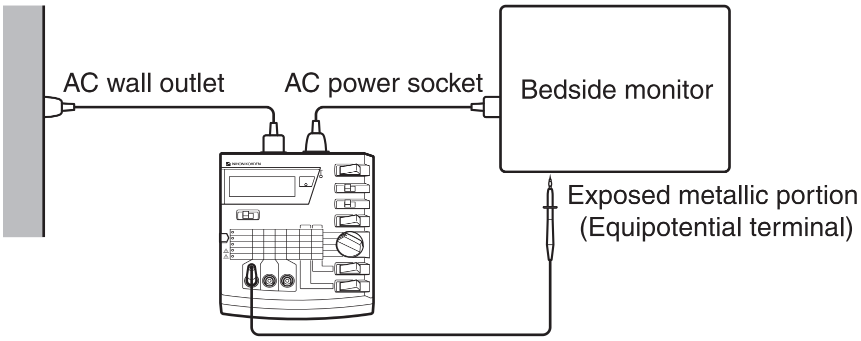

AC wall outlet
AC power socket
Bedside monitor

Leak current checker

- Make sure that the measured value is within the range below.

Normal condition	500 µA or less
Single-fault condition	1 mA or less

<Example of measuring enclosure leakage current>

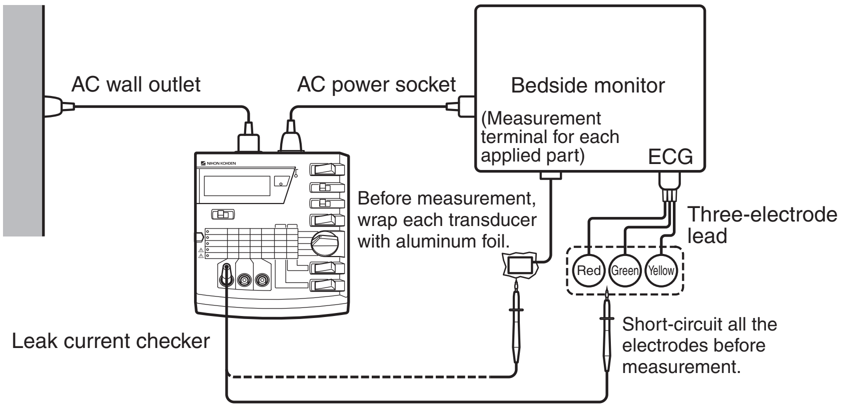

AC wall outlet
AC power socket
Bedside monitor
Exposed metallic portion
(Equipotential terminal)

Leak current checker

- Make sure that the measured value is within the range below.

Normal condition	100 µA or less
Single-fault condition	500 µA or less

<Example of measuring patient leakage current I>


AC wall outlet
AC power socket
Bedside monitor
(Measurement terminal for each applied part)
ECG
Before measurement, wrap each transducer with aluminum foil.
Three-electrode lead
Red
Green
Yellow
Short-circuit all the electrodes before measurement.
Leak current checker

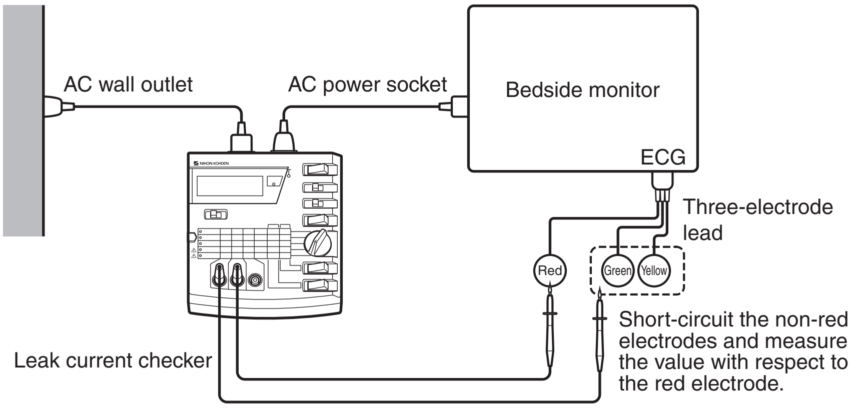
Measure the patient leakage current flowing in the measurement system for each parameter other than NIBP and CO_2. For the ECG, short-circuit all the electrode leads before measurement. For the other parameters, wrap the transducer with aluminum foil before measurement.

- Make sure that the measured value is within the range below.

Normal condition	10 μA or less
Single-fault condition	50 μA or less

* If you are using the leak current checker as a leak current measuring instrument, first measure the current in the DC+AC mode to make sure that the above DC range is satisfied. If the allowable value is exceeded, you need to measure the current in the DC mode again; the result is considered successful if the above DC range is satisfied.

<Example of measuring patient auxiliary current>


AC wall outlet
AC power socket
Bedside monitor
ECG
Three-electrode lead
Red
Green
Yellow
Short-circuit the non-red electrodes and measure the value with respect to the red electrode.
Leak current checker

For the ECG, measure the patient auxiliary current (AC). Short-circuit the non-red electrode leads for the ECG and measure the value with respect to the red one.

- Make sure that the measured value is within the range below.

Normal condition	10 μA or less
Single-fault condition	50 μA or less

Section 4 Board/Unit Description

Overall Connection Diagram....................4.2

MU-631R/MU-651R/MU-671R....................4.2

AY-600P Series/AA-672P/AA-674P....................4.3

Overall Block Diagram....................4.4

MU-631R/MU-651R/MU-671R....................4.4

AY-600P Series/AA-672P/AA-674P....................4.5

Internal Cable Connections....................4.6

MU-631R Wiring Diagram....................4.6

MU-631R Cable List....................4.7

MU-651R Wiring Diagram....................4.8

MU-651R Cable List....................4.9

MU-671R Wiring Diagram....................4.10

MU-671R Cable List....................4.11

MU-631R/MU-651R/MU-671R Main Unit....................4.12

UR-3945/UR-39450/UR-39451 MAIN DIGITAL Board....................4.12

UR-3956 FRONT I/F Board....................4.17

UR-3962 Front Mother Board Set....................4.18

UR-3966 INPUT I/F Board....................4.19

UR-3951/39510 ECG RESP Board....................4.20

UR-3950/39500 ECG Connector Board....................4.22

UR-39370/39371/39373 Multi Parameter Unit Board (MPU Board)....................4.23

UR-3940/39400 TEMP Board....................4.28

UR-3938/39380/3972/39721 Multi Parameter Unit Power Board....................4.29

UR-3949/39490 AY MOTHER (INPUT MOTHER) Board....................4.32

UR-3908/39081 SpO_2 Board....................4.34

UR-39462/39464 External Multi Parameter Unit Board (EXTMPU Board)....................4.36

UR-3947 External Multi Parameter Unit Connection Board....................4.40

QI-631P Interface (MIX)....................4.40

QI-632P Interface (ML)....................4.41

QI-634P Interface....................4.42

QI-671P Interface....................4.43

QI-672P Interface....................4.44

WS-671P Recorder Module....................4.45

UR-3942 WS Power Board....................4.45

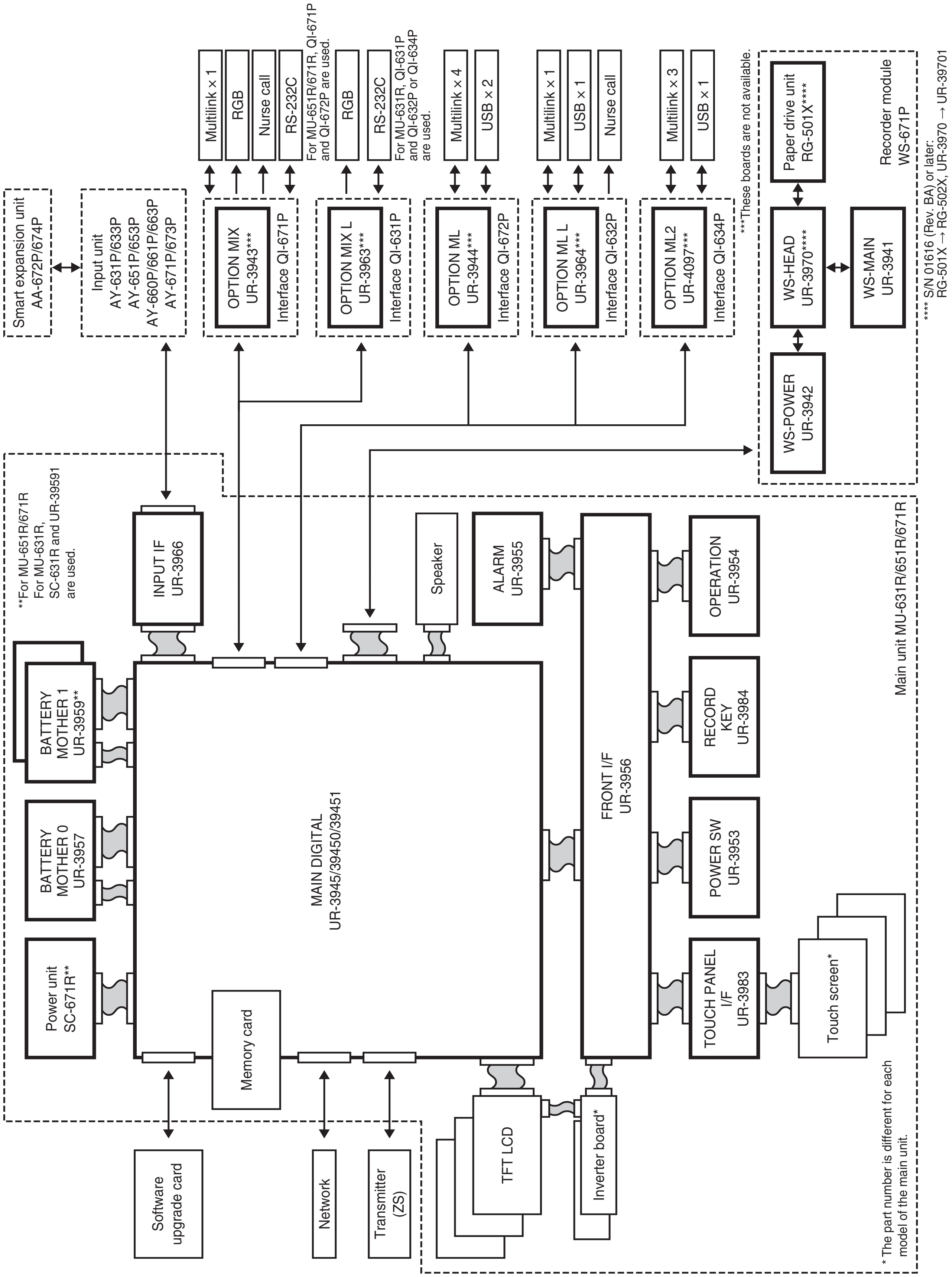
UR-3941 WS Main Board....................4.46

UR-3970/39701 WS Head Board....................4.47

RG-501X/502X Paper Drive Unit....................4.48

Overall Connection Diagram

MU-631R/MU-651R/MU-671R


Smart expansion unit
AA-672P/674P
Input unit
AY-631P/633P
AY-651P/653P
AY-660P/661P/663P
AY-671P/673P
OPTION MIX
UR-3943***
Interface QI-671P
Multilink × 1
RGB
Nurse call
RS-232C
OPTION MIX L
UR-3963***
Interface QI-631P
RGB
RS-232C
OPTION ML
UR-3944***
Interface QI-672P
Multilink × 4
USB × 2
OPTION ML L
UR-3964***
Interface QI-632P
Multilink × 1
USB × 1
Nurse call
OPTION ML2
UR-4097***
Interface QI-634P
Multilink × 3
USB × 1
Paper drive unit
RG-501X****
WS-HEAD
UR-3970****
WS-MAIN
UR-3941
WS-POWER
UR-3942
Recorder module
WS-671P
INPUT IF
UR-3966
Speaker
ALARM
UR-3955
OPERATION
UR-3954
RECORD
KEY
UR-3984
POWER SW
UR-3953
TOUCH PANEL
I/F
UR-3983
Touch screen*
FRONT I/F
UR-3956
BATTERY
MOTHER 1
UR-3959**
BATTERY
MOTHER 0
UR-3957
Power unit
SC-671R**
MAIN DIGITAL
UR-3945/39450/39451
Memory card
TFT LCD
Inverter board*
Software
upgrade card
Network
Transmitter
(ZS)
Main unit MU-631R/651R/671R

For MU-651R/671R, QI-671P and QI-672P are used.

For MU-631R, QI-631P and QI-632P or QI-634P are used.

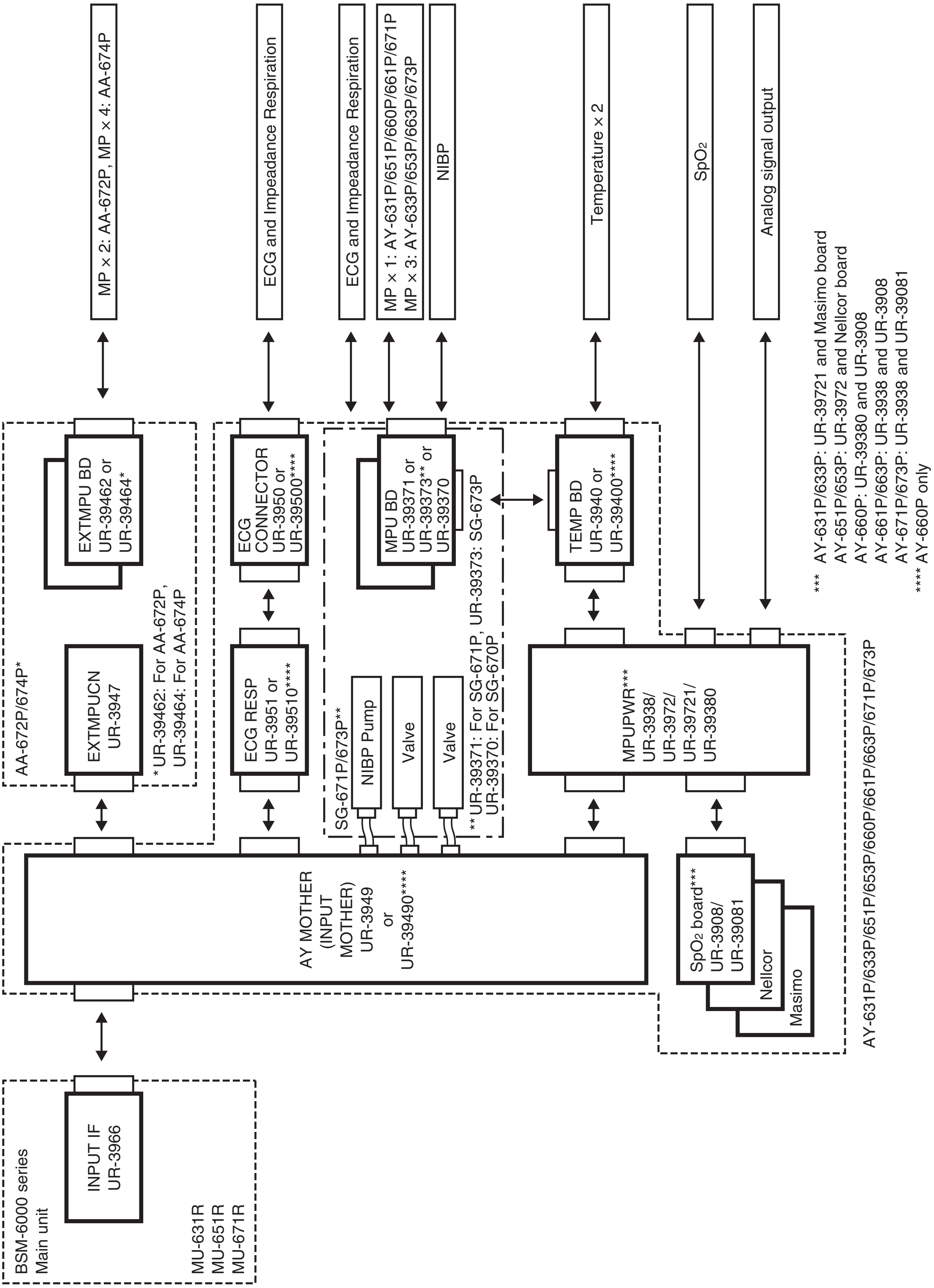
***These boards are not available.

**** S/N 01616 (Rev. BA) or later:
RG-501X → RG-502X, UR-3970 → UR-39701

**For MU-651R/671R
For MU-631R,
SC-631R and UR-39591
are used.

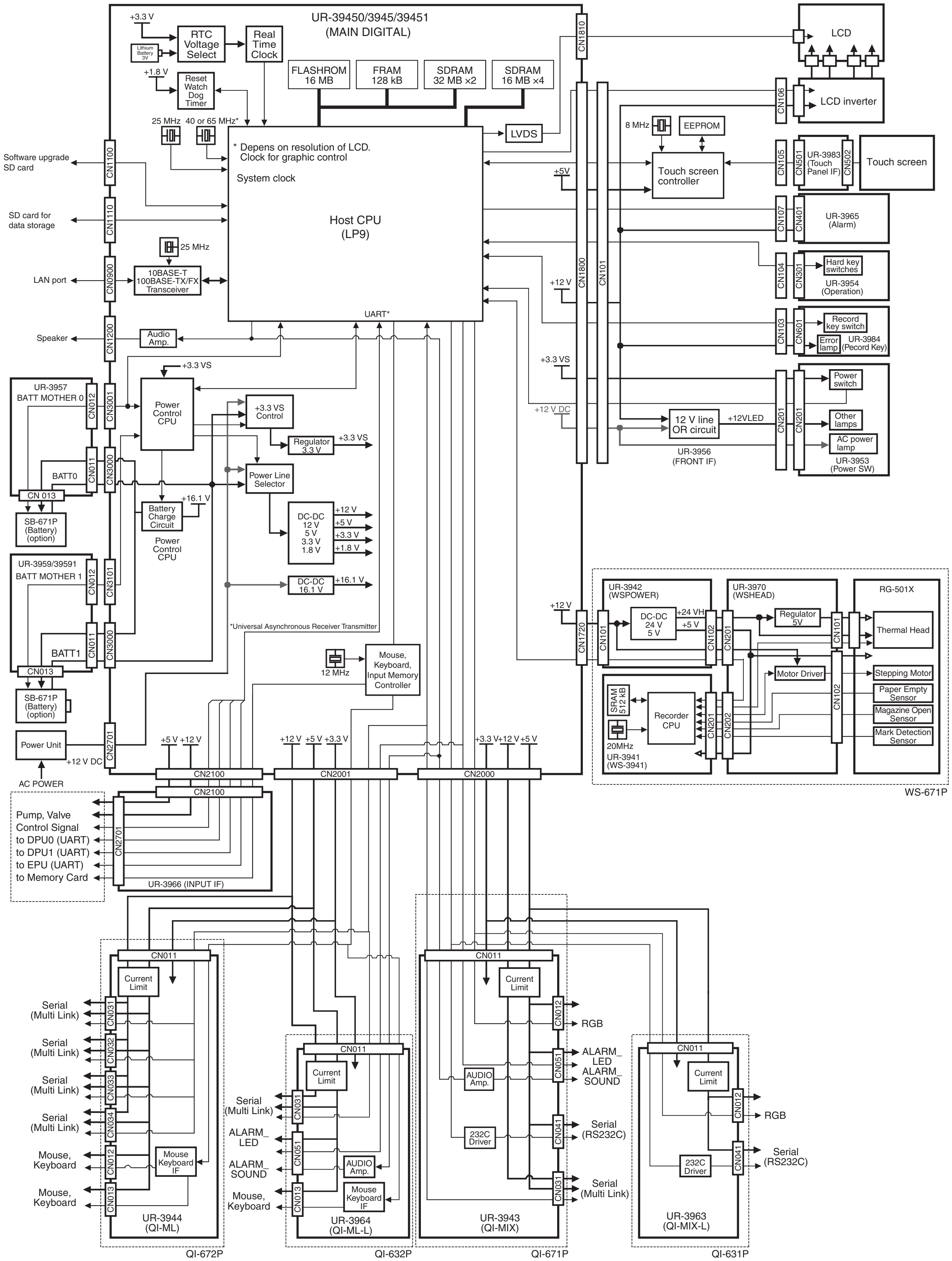
* The part number is different for each model of the main unit.

AY-600P Series/AA-672P/AA-674P

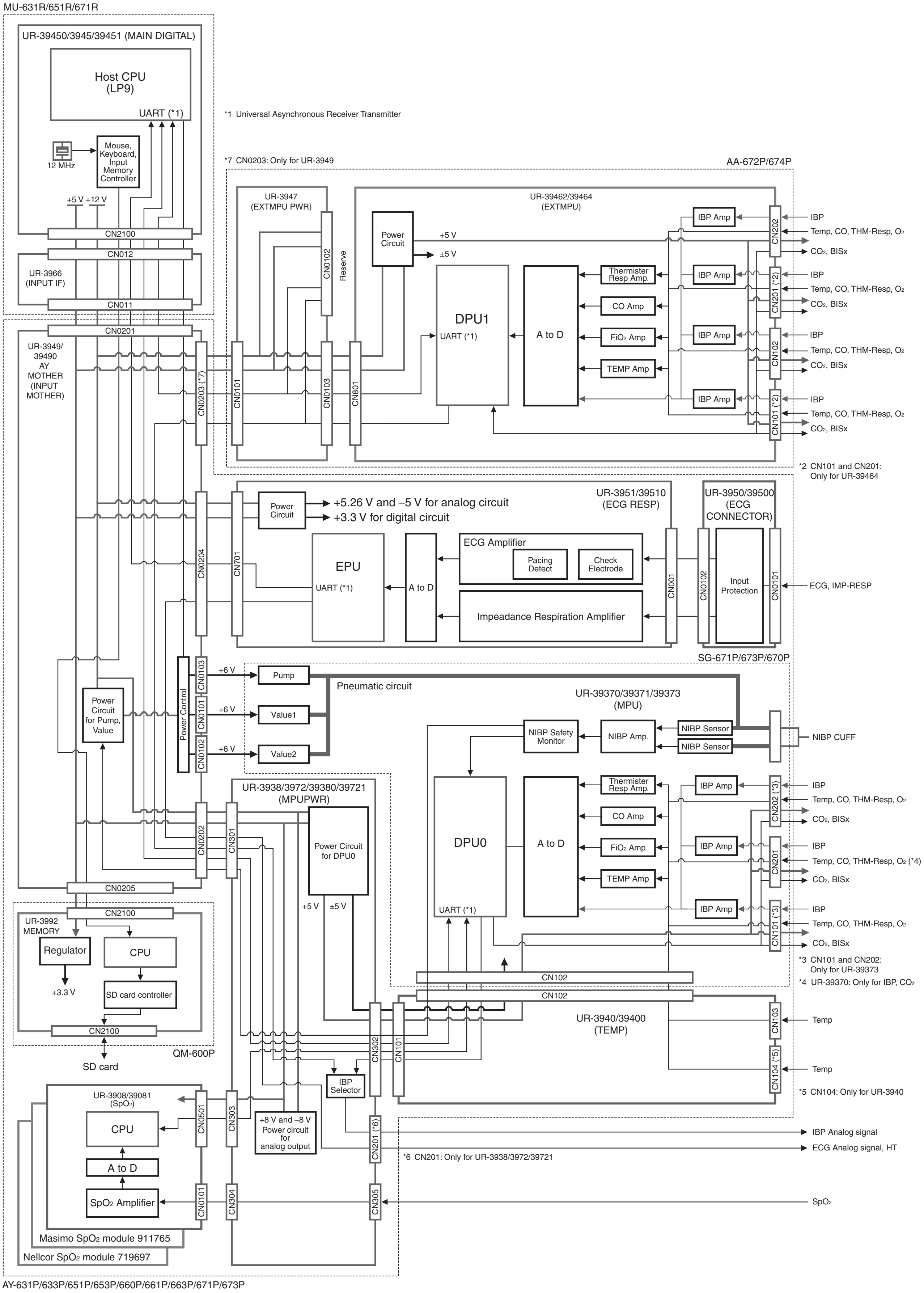

MP × 2: AA-672P, MP × 4: AA-674P
ECG and Impeadance Respiration
ECG and Impeadance Respiration
MP × 1: AY-631P/651P/660P/661P/671P
MP × 3: AY-633P/653P/663P/673P
NIBP
Temperature × 2
SpO2
Analog signal output
*** AY-631P/633P: UR-39721 and Masimo board
AY-651P/653P: UR-3972 and Nellcor board
AY-660P: UR-39380 and UR-3908
AY-661P/663P: UR-3938 and UR-3908
AY-671P/673P: UR-3938 and UR-39081
**** AY-660P only
EXTMPU BD
UR-39462 or
UR-39464*
ECG
CONNECTOR
UR-3950 or
UR-39500****
MPU BD
UR-39371 or
UR-39373** or
UR-39370
TEMP BD
UR-3940 or
UR-39400****
AA-672P/674P*
EXTMPUCN
UR-3947
* UR-39462: For AA-672P,
UR-39464: For AA-674P
ECG RESP
UR-3951 or
UR-39510****
SG-671P/673P**
NIBP Pump
Valve
Valve
** UR-39371: For SG-671P, UR-39373: SG-673P
UR-39370: For SG-670P
MPUPWR***
UR-3938/
UR-3972/
UR-39721/
UR-39380
AY MOTHER
(INPUT
MOTHER)
UR-3949
or
UR-39490****
SpO2 board***
UR-3908/
UR-39081
Nellcor
Masimo
AY-631P/633P/651P/653P/660P/661P/663P/671P/673P
BSM-6000 series
Main unit
INPUT IF
UR-3966
MU-631R
MU-651R
MU-671R

Overall Block Diagram

MU-631R/MU-651R/MU-671R


UR-39450/3945/39451
(MAIN DIGITAL)
+3.3 V
Lithium Battery 3V
RTC Voltage Select
Real Time Clock
+1.8 V
Reset Watch Dog Timer
FLASHROM 16 MB
FRAM 128 kB
SDRAM 32 MB ×2
SDRAM 16 MB ×4
25 MHz
40 or 65 MHz*
* Depens on resolution of LCD.
Clock for graphic control
System clock
Host CPU
(LP9)
LVDS
UART*
Software upgrade SD card
SD card for data storage
LAN port
Speaker
CN1100
CN1110
CN0900
CN1200
25 MHz
10BASE-T 100BASE-TX/FX Transceiver
Audio Amp.
+3.3 VS
UR-3957
BATT MOTHER 0
CN012
CN011
BATT0
CN 013
SB-671P (Battery) (option)
CN3001
CN3000
Power Control CPU
+3.3 VS Control
Regulator 3.3 V
+3.3 VS
Power Line Selector
+16.1 V
Battery Charge Circuit
Power Control CPU
DC-DC 12 V 5 V 3.3 V 1.8 V
+12 V
+5 V
+3.3 V
+1.8 V
DC-DC 16.1 V
+16.1 V
UR-3959/39591
BATT MOTHER 1
CN012
CN011
BATT1
CN013
SB-671P (Battery) (option)
CN3101
CN3000
*Universal Asynchronous Receiver Transmitter
12 MHz
Mouse, Keyboard, Input Memory Controller
Power Unit
+12 V DC
AC POWER
CN2701
+5 V +12 V
+12 V +5 V +3.3 V
+3.3 V +12 V +5 V
CN2100
CN2001
CN2000
CN2100
Pump, Valve Control Signal
to DPU0 (UART)
to DPU1 (UART)
to EPU (UART)
to Memory Card
CN2701
UR-3966 (INPUT IF)
CN1810
CN1800
CN101
LCD
CN106
LCD inverter
8 MHz
EEPROM
+5V
Touch screen controller
CN105
CN501
UR-3983 (Touch Panel IF)
CN502
Touch screen
CN107
CN401
UR-3965 (Alarm)
CN104
CN301
Hard key switches
UR-3954 (Operation)
+12 V
CN103
CN601
Record key switch
Error lamp
UR-3984 (Pecord Key)
+3.3 VS
+12 V DC
12 V line OR circuit
+12VLED
UR-3956 (FRONT IF)
CN201
CN201
Power switch
Other lamps
AC power lamp
UR-3953 (Power SW)
+12 V
CN1720
UR-3942 (WSPOWER)
CN101
DC-DC 24 V 5 V
+24 VH
+5 V
CN102
UR-3970 (WSHEAD)
CN201
Regulator 5V
CN101
RG-501X
Thermal Head
Motor Driver
Stepping Motor
CN102
Paper Empty Sensor
Magazine Open Sensor
Mark Detection Sensor
SRAM 512 kB
Recorder CPU
20MHz
UR-3941 (WS-3941)
CN201
CN202
WS-671P
CN011
Current Limit
Serial (Multi Link)
CN031
Serial (Multi Link)
CN032
Serial (Multi Link)
CN033
Serial (Multi Link)
CN034
Mouse, Keyboard
CN012
Mouse Keyboard IF
Mouse, Keyboard
CN013
UR-3944 (QI-ML)
QI-672P
CN011
Current Limit
Serial (Multi Link)
CN031
ALARM_ LED
CN051
ALARM_ SOUND
AUDIO Amp.
Mouse, Keyboard
CN013
Mouse Keyboard IF
UR-3964 (QI-ML-L)
QI-632P
CN011
Current Limit
CN012
RGB
AUDIO Amp.
CN051
ALARM_ LED
ALARM_ SOUND
232C Driver
CN041
Serial (RS232C)
CN031
Serial (Multi Link)
UR-3943 (QI-MIX)
QI-671P
CN011
Current Limit
CN012
RGB
232C Driver
CN041
Serial (RS232C)
UR-3963 (QI-MIX-L)
QI-631P

AY-600P Series/AA-672P/AA-674P


MU-631R/651R/671R
UR-39450/3945/39451 (MAIN DIGITAL)
Host CPU (LP9)
UART (*1)
12 MHz
Mouse, Keyboard, Input Memory Controller
+5 V +12 V
CN2100
CN012
UR-3966 (INPUT IF)
CN011
CN0201
UR-3949/39490 AY MOTHER (INPUT MOTHER)
CN0203 (*7)
AA-672P/674P
UR-3947 (EXTMPU PWR)
CN0102
Reserve
CN0101
CN0103
CN801
UR-39462/39464 (EXTMPU)
Power Circuit
+5 V
±5 V
DPU1
UART (*1)
A to D
Thermister Resp Amp.
CO Amp
FiO2 Amp
TEMP Amp
IBP Amp
CN202
CN201 (*2)
CN102
CN101 (*2)
IBP
Temp, CO, THM-Resp, O2
CO2, BISx
CN0204
CN701
Power Circuit
+5.26 V and –5 V for analog circuit
+3.3 V for digital circuit
UR-3951/39510 (ECG RESP)
UR-3950/39500 (ECG CONNECTOR)
EPU
UART (*1)
A to D
ECG Amplifier
Pacing Detect
Check Electrode
Impeadance Respiration Amplifier
CN001
CN0102
Input Protection
CN0101
ECG, IMP-RESP
SG-671P/673P/670P
Power Control
CN0103
CN0101
CN0102
+6 V
Pump
Value1
Value2
Pneumatic circuit
Power Circuit for Pump, Value
UR-39370/39371/39373 (MPU)
NIBP Safety Monitor
NIBP Amp.
NIBP Sensor
NIBP CUFF
DPU0
UART (*1)
A to D
Thermister Resp Amp.
CO Amp
FiO2 Amp
TEMP Amp
IBP Amp
CN202 (*3)
CN201
CN101 (*3)
Temp, CO, THM-Resp, O2 (*4)
CN102
UR-3938/3972/39380/39721 (MPUPWR)
Power Circuit for DPU0
+5 V ±5 V
CN0202
CN301
CN0205
UR-3940/39400 (TEMP)
CN103
CN104 (*5)
Temp
CN302
CN101
IBP Selector
CN201 (*6)
IBP Analog signal
ECG Analog signal, HT
UR-3992 MEMORY
CN2100
Regulator
CPU
+3.3 V
SD card controller
QM-600P
SD card
UR-3908/39081 (SpO2)
CPU
A to D
SpO2 Amplifier
CN0501
CN0101
CN303
CN304
CN305
+8 V and –8 V Power circuit for analog output
SpO2
Masimo SpO2 module 911765
Nellcor SpO2 module 719697
AY-631P/633P/651P/653P/660P/661P/663P/671P/673P

*1 Universal Asynchronous Receiver Transmitter

*7 CN0203: Only for UR-3949

*2 CN101 and CN201: Only for UR-39464

*3 CN101 and CN202: Only for UR-39373

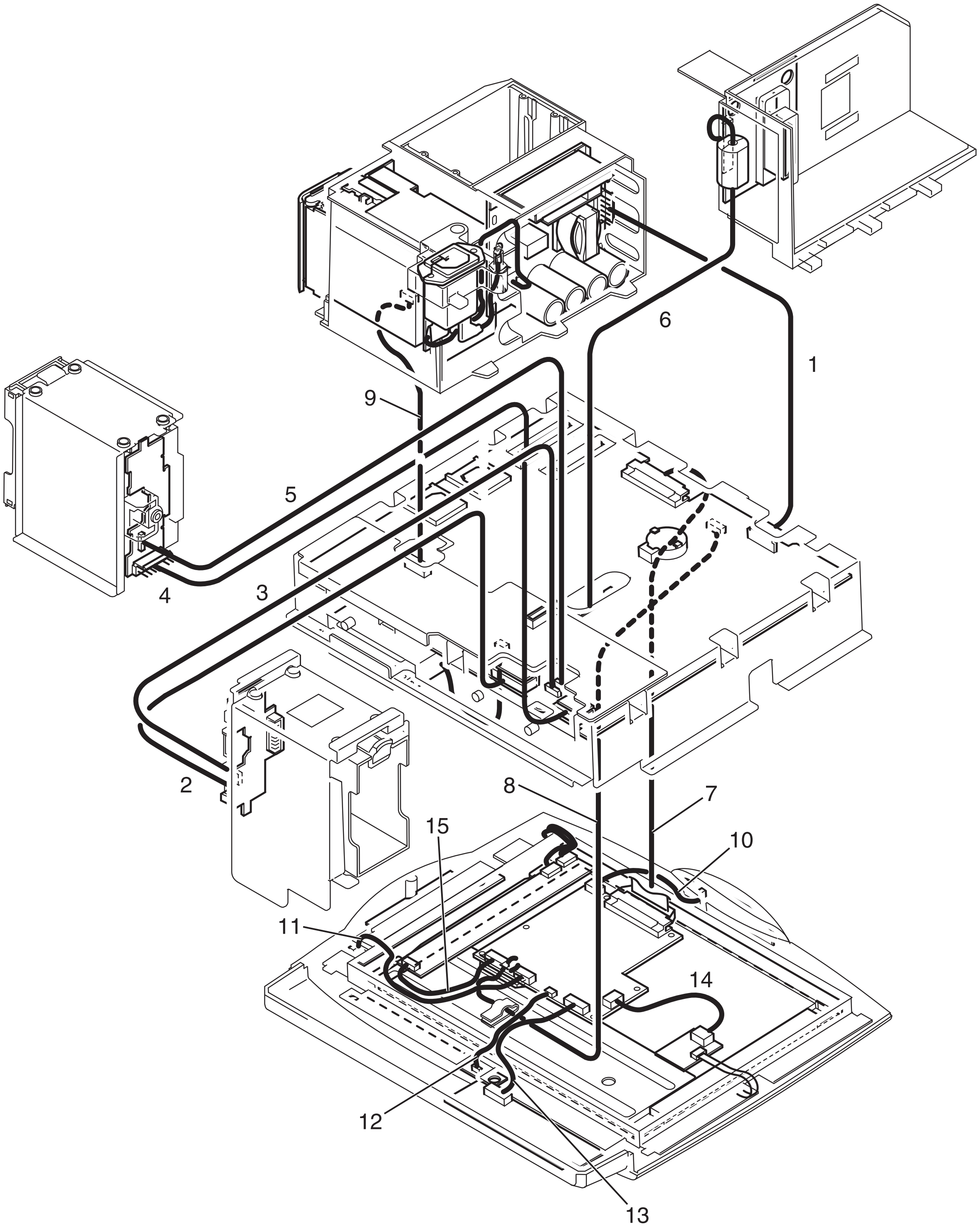
*4 UR-39370: Only for IBP, CO2

*5 CN104: Only for UR-3940

*6 CN201: Only for UR-3938/3972/39721

Internal Cable Connections

MU-631R Wiring Diagram


6
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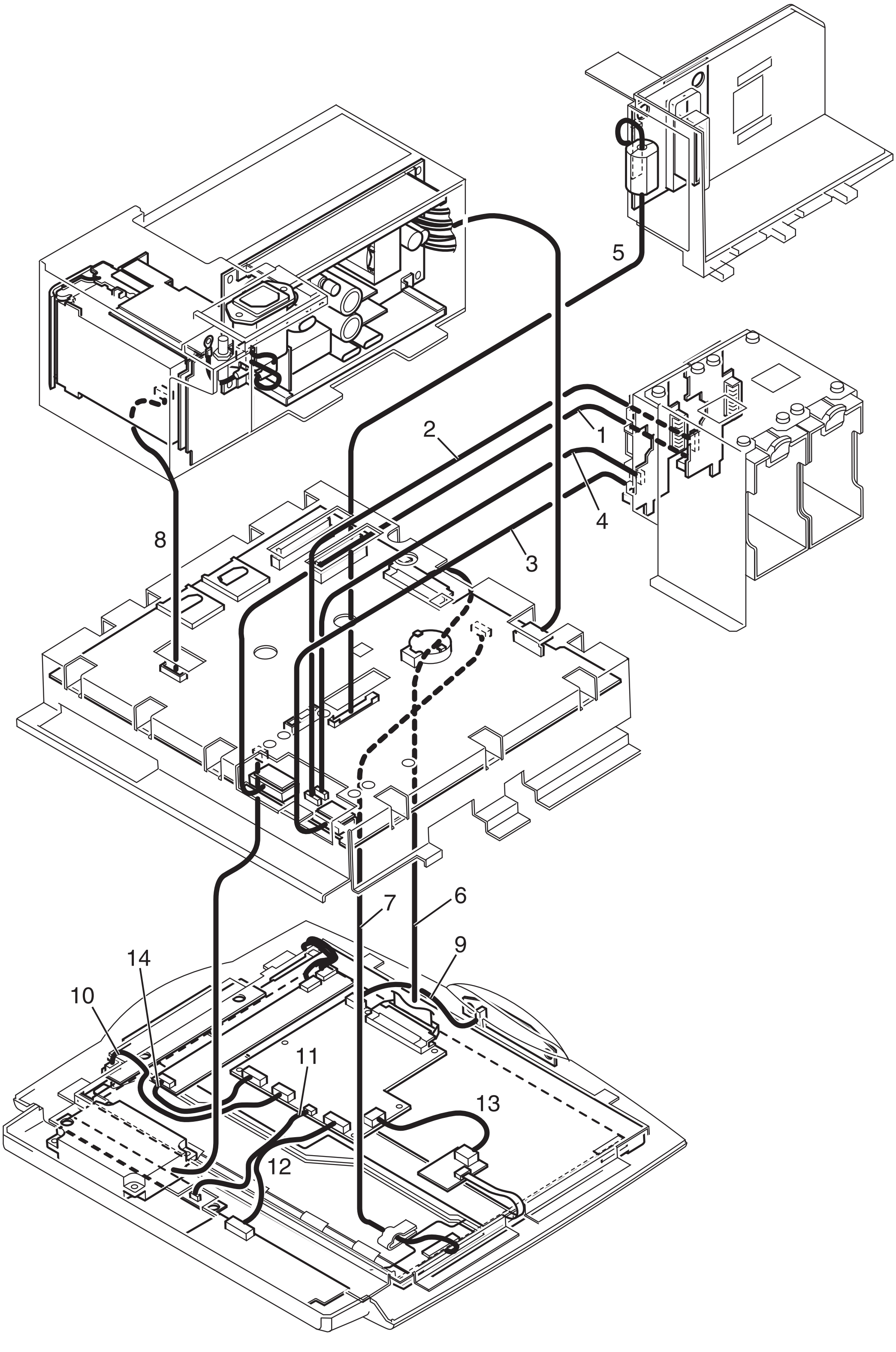
MU-631R Cable List

Connecting Cables			Board 1		Board 2	
No.	Part Codes	Part names	Board No.	Connector No.	Board No.	Connector No.
1	903034	VHR-6N (W150)	UR-39450	CN2701	NIH-Z067-1	TB2
2	716156	VHR-7N (W160)	UR-39450	CN3000	UR-3957	CN011
3	716058	DF13-8S-1.25C (W160)	UR-39450	CN3001	UR-3957	CN012
4	716147	VHR-6N (W160)	UR-39450	CN3100	UR-39591	CN014
5	716049	DF13-6S-1.25C (W160)	UR-39450	CN3101	UR-39591	CN015
6	721364	LY10-DC36 twisted at both wire ends (W170)	UR-39450	CN2100	UR-3966	CN012
7	721355	8825E-050-175F-005-GH	UR-39450	CN1800	UR-3956	CN101
8	921496	SHDR20VSB_DF19G20S1CLVDS (W415)	UR-39450	CN1810	LT104AD18600	CN1
9	920033	DF11-12DS-2C (W180)	UR-39450	CN1720	WS-671P	—
10	721382	PHR-5 (W130)	UR-3956	CN107	UR-3955	CN401
11	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-3956	CN104	UR-3954	CN301
12	716031	DF13-4S-1.25C (W120)	UR-3956	CN103	UR-3984	CN601
13	718698	PHDR-16VS (W180)	UR-3956	CN102	UR-3953	CN201
14	721899	PHR-4 (W150)AWG28	UR-3956	CN105	UR-3983	CN501
15	721391	PHR-7/51021-0700 (W115)	UR-3956	CN106	CXA-0454	CN1

MU-651R Wiring Diagram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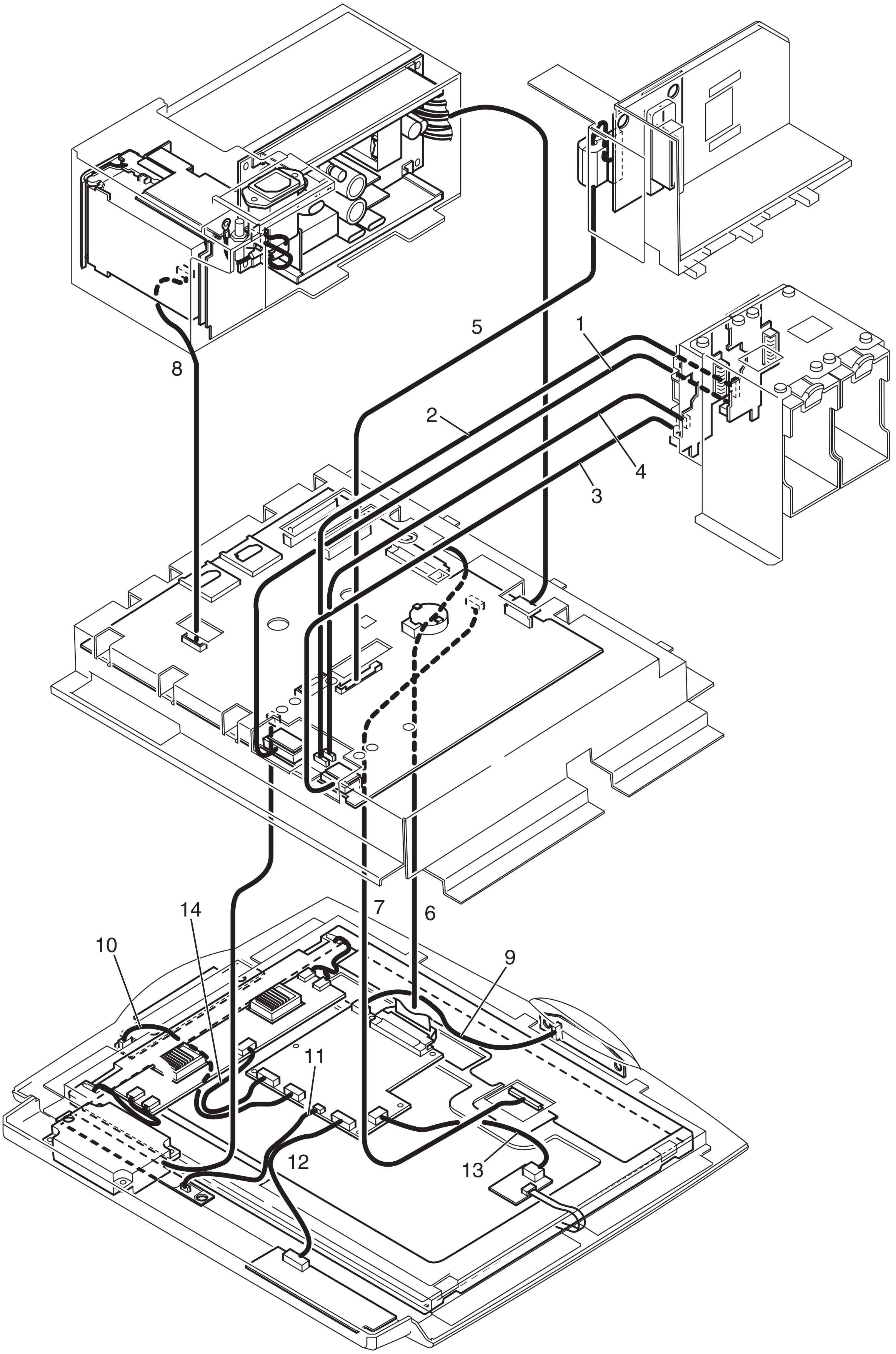
MU-651R Cable List

Connecting Cables			Board 1		Board 2	
No.	Part Codes	Part names	Board No.	Connector No.	Board No.	Connector No.
1	716156	VHR-7N (W160)	UR-3945	CN3000	UR-3957	CN011
2	716058	DF13-8S-1.25C (W160)	UR-3945	CN3001	UR-3957	CN012
3	716147	VHR-6N (W160)	UR-3945	CN3100	UR-3959	CN011
4	716049	DF13-6S-1.25C (W160)	UR-3945	CN3101	UR-3959	CN012
5	721364	LY10-DC36 twisted at both wire ends (W170)	UR-3945	CN2100	UR-3966	CN012
6	721355	8825E-050-175F-005-GH	UR-3945	CN1800	UR-3956	CN101
7	722104A	SHDR-20V_FI-S20S (W380)_LVDS	UR-3945	CN1810	LQ121S1LG46	CN1
8	920033	DF11-12DS-2C (W180)	UR-3945	CN1720	WS-671P	—
9	721382	PHR-5 (W130)	UR-3956	CN107	UR-3955	CN401
10	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-3956	CN104	UR-3954	CN301
11	716031	DF13-4S-1.25C (W120)	UR-3956	CN103	UR-3984	CN601
12	718698	PHDR-16VS (W180)	UR-3956	CN102	UR-3953	CN201
13	721899	PHR-4 (W150) AWG28	UR-3956	CN105	UR-3983	CN501
14	721391	PHR-7/51021-0700 (W115)	UR-3956	CN106	CXA-0454	CN1

MU-671R Wiring Diagram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MU-671R Cable List

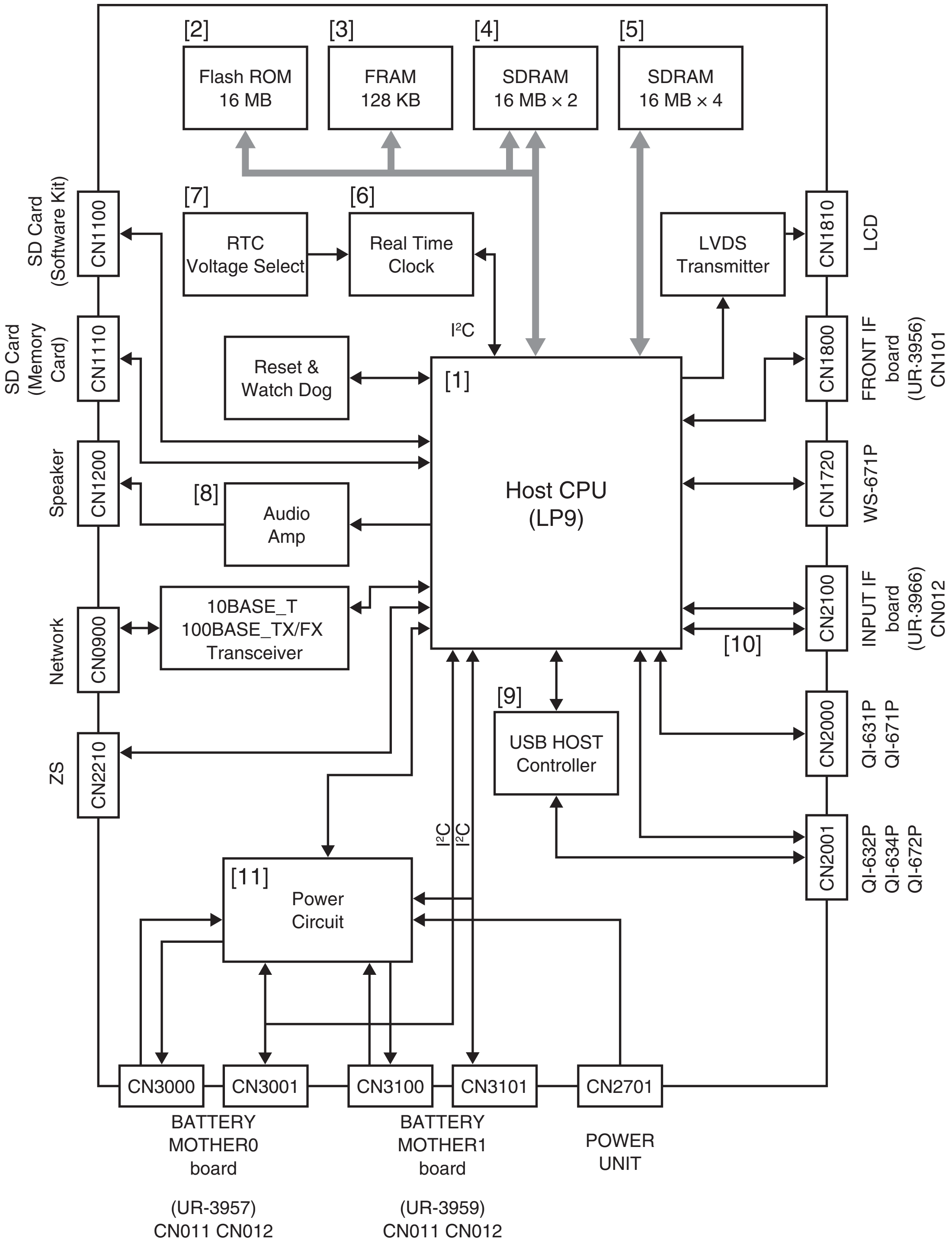
Connecting Cables			Board 1		Board 2	
No.	**Part Codes**	**Part names**	**Board No.**	**Connector No.**	**Board No.**	**Connector No.**
1	716156	VHR-7N (W160)	UR-39451	CN3000	UR-3957	CN011
2	716058	DF13-8S-1.25C (W160)	UR-39451	CN3001	UR-3957	CN012
3	716147	VHR-6N (W160)	UR-39451	CN3100	UR-3959	CN011
4	716049	DF13-6S-1.25C (W160)	UR-39451	CN3101	UR-3959	CN012
5	721364	LY10-DC36 twisted at both wire ends (W170)	UR-39451	CN2100	UR-3966	CN012
6	721355	8825E-050-175F-005-GH	UR-39451	CN1800	UR-3956	CN101
7	722096	SHDR-20V_DF14-20S (W430)_LVDS	UR-39451	CN1810	LQ150X1LW72	CN1
8	920033	DF11-12DS-2C (W180)	UR-39451	CN1720	WS-671P	—
9	721382	PHR-5 (W130)	UR-3956	CN107	UR-3955	CN401
10	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-3956	CN104	UR-3954	CN301
11	716031	DF13-4S-1.25C (W120)	UR-3956	CN103	UR-3984	CN601
12	718698	PHDR-16VS (W180)	UR-3956	CN102	UR-3953	CN201
13	721899	PHR-4 (W150) AWG28	UR-3956	CN105	UR-3983	CN501
14	716129	PHR-7 (W115)	UR-3956	CN106	CXA-0349	CN01

MU-631R/MU-651R/MU-671R Main Unit

UR-3945/UR-39450/UR-39451 MAIN DIGITAL Board

Outline of Function

MAIN DIGITAL board (UR-3945/UR-39450/UR-39451) is used in a monitor main unit (MU-631R/MU-651R/MU-671R) to perform digital processing and supply power to the overall monitor.


[2] Flash ROM 16 MB
[3] FRAM 128 KB
[4] SDRAM 16 MB × 2
[5] SDRAM 16 MB × 4
[7] RTC Voltage Select
[6] Real Time Clock
I²C
Reset & Watch Dog
LVDS Transmitter
[1] Host CPU (LP9)
[8] Audio Amp
10BASE_T 100BASE_TX/FX Transceiver
[9] USB HOST Controller
[10]
[11] Power Circuit
I²C
I²C
SD Card (Software Kit) CN1100
SD Card (Memory Card) CN1110
Speaker CN1200
Network CN0900
ZS CN2210
CN1810 LCD
CN1800 FRONT IF board (UR-3956) CN101
CN1720 WS-671P
CN2100 INPUT IF board (UR-3966) CN012
CN2000 QI-631P QI-671P
CN2001 QI-632P QI-634P QI-672P
CN3000
CN3001
BATTERY MOTHER0 board (UR-3957) CN011 CN012
CN3100
CN3101
BATTERY MOTHER1 board (UR-3959) CN011 CN012
CN2701 POWER UNIT

Explanation of Each Circuit Block Operations

[1] Host CPU (LP9)

- System Control

  Immediately after the power is turned on, Host CPU (LP9) checks for the existence of a software kit by using the boot program (IPL) in the flash ROM.

  If a software kit compatible with the device type is detected, the state of rewriting the program in flash ROM is engaged. If a software kit compatible with the device type is not detected, the main program in the flash ROM is to be executed.
- Display Control

  Processes display data, and conducts the LVDS output for LCD and the analog RGB output to external displays.

  Analog RGB output specifications
  - MU-671R

    Resolution: XGA (1024 × 768)
    HSYNC: 48.4 kHz (20.7 µs)
    VSYNC: 60 Hz (16.67 ms)
  - MU-651R/MU-631R

    Resolution: SVGA (800 × 600)
    HSYNC: 37.87 kHz (26.4 µs)
    VSYNC: 60.3 Hz (16.6 ms)
- Sound Control

  Can generate the alarm sound, heart rate synchronous sound, and key sound concurrently. Also controls sound volume. Conducts PWM output.
- Serial Communication (touch panel)

  Performs serial communication with touch screen controller incorporated in the FRONT IF board (UR-3956).
- Serial Communication (remote control)

  Performs serial communication with the receiver IC incorporated in the FRONT IF board (UR-3956).
- Serial Communication (recorder module)

  Performs serial communication with WS-671P.
- Serial Communication (multi link)

  Performs serial communication with the multi link device connected via the optional board (QI-632P/634P/671P/672P).
- Serial Communication (transmitter)

  Performs serial communication with the transmitter connected to CN2210.
- Serial communication (input unit)

  Performs serial communication with AY-600P series EPU (UR-3951), DPU0 (UR-39370/39371/39373), and AA-672P/674P DPU1 (UR-39462/39464).
- Serial Communication (serial connector)

  Communication settings can be made under the following conditions.

  Communication method: Asynchronous
  Baud rate: 9600 bps/19200 bps/38400 bps
  Data length: 7 bits/8 bits
  Parity check: None/even number/odd number
  Stop bit: 1 bit/2 bits

- Key
  Detects an action of pressing the [Silence Alarms] key, [NIBP Interval] key, [NIBP Start/Stop] key, [Menu] key, [Home] key, or [Record/Stop] key.
- Brightness Adjustment
  Conducts PWM output corresponding to a set LCD brightness. The PWM output is converted into analog and the brightness is adjusted by the inverter.
- Network
  Performs network communication. A unique MAC address is assigned to each MAIN board and it is stored in flash ROM.
- I^2C Communication (Real Time Clock)
  Acquires current date and time from Real Time Clock.
- I^2C Communication (battery)
  Acquires battery status (voltage, remaining battery level, etc.).
- Serial-to-Parallel Conversion
  Receives serial signals containing detection of the serial connector's overcurrent and CTS/DSR information, etc., and performs parallel conversion.
- Parallel-to-Serial Conversion
  Converts alarm information, serial connector's RTS/DTR information, and multi link control signals, etc. to serial, and outputs them.
- SD Card
  Performs communication with the memory card, an SD card, and the software kit.

[2] Flash ROM (16 MB)
The flash ROM stores the boot program, the main program, and the MAC address for the device.

[3] FRAM (128 KB)
The FRAM stores system setup data and alarm setting values, etc. These data are kept even after the power is turned off.

[4] SDRAM (16 MB × 2)
Records data related to Host CPU processes.

[5] SDRAM (16 MB × 4)
Records data for screen display.

[6] Real Time Clock
Keeps time. Kept activated even while the power is turned off by the lithium battery power.

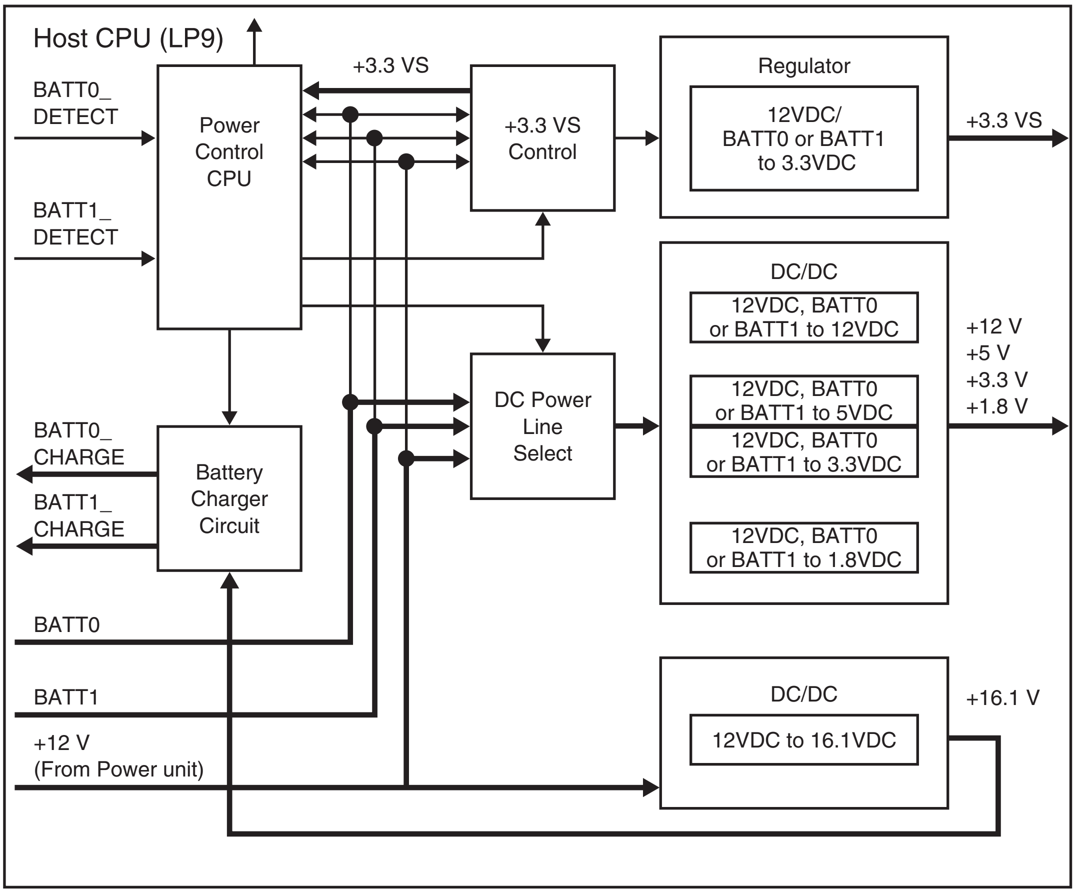
[7] RTC Voltage Select
Changes power source to be supplied to real time clock.
While the power is turned ON, the power is supplied from the power circuit.
While the power is turned OFF, the power is supplied from the lithium battery.

[8] Audio Amp.
Converts PWM signals output from Host CPU into analog signals, and drives the speaker.

[9] USB HOST Controller
Performs USB communication with the QI-ML board (UR-3944) under the control of Host CPU.
(For MU-631R, performs USB communication with the QI-ML-L board (UR-3964) and OPTION ML 2 board (UR-4097).)
When the memory board (QM-600P) is mounted on the input unit, it also performs USB communication with the memory board.

[10]NIBP Control
The NIBP pump and solenoid valve are controlled from the Host CPU (LP9) port.

[11]Power Circuit


Host CPU (LP9)
+3.3 VS
BATT0_ DETECT
BATT1_ DETECT
Power Control CPU
+3.3 VS Control
Regulator
12VDC/ BATT0 or BATT1 to 3.3VDC
+3.3 VS
DC/DC
12VDC, BATT0 or BATT1 to 12VDC
12VDC, BATT0 or BATT1 to 5VDC
12VDC, BATT0 or BATT1 to 3.3VDC
12VDC, BATT0 or BATT1 to 1.8VDC
+12 V
+5 V
+3.3 V
+1.8 V
DC Power Line Select
BATT0_ CHARGE
BATT1_ CHARGE
Battery Charger Circuit
BATT0
BATT1
+12 V (From Power unit)
DC/DC
12VDC to 16.1VDC
+16.1 V

- Power Control CPU
  Performs communication with Host CPU, detects ON/OFF of the power switch, controls the +3.3 VS Control circuit, controls the power line select circuit, and controls the battery charge circuit.

  Controls the power on/off status as follows: If the AC power supply is stopped (in a condition of no battery) due to interruption of electric service or others, and afterwards the power supply is recovered, the monitor power is automatically turned on.

- +3.3 VS Control
  When the AC power is connected, generates +3.3 VS from +12 V regardless of the monitor power ON/OFF status.

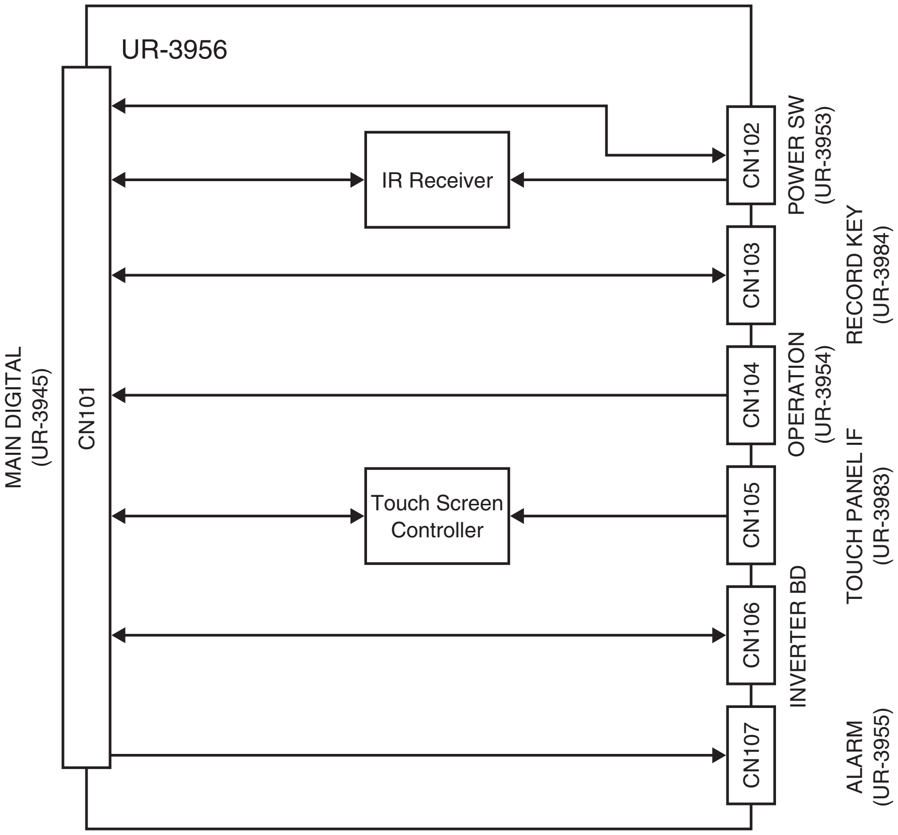
  When the AC power is not connected, generates +3.3 VS from BATT0 or BATT1 immediately after the device is powered ON.
- Power Line Select
  When the AC power is connected, +12 V is used regardless of whether the battery is loaded or not. When two batteries are loaded, Host CPU communicates with the batteries and uses the one with less remaining capacity first.
- Battery Charge Circuit
  When the AC power is connected and the battery is loaded, supplies charging current to the battery. When the power is turned OFF, two batteries are simultaneously charged. When the power is turned ON, only one battery is charged at one time (batteries are charged one by one in order).
- Regulator
  Outputs +3.3 VS when the power is turned ON. It outputs even while the power is turned off, as long as the AC power is connected.
- DC/DC

+16.1 V	Output regardless of the power ON/OFF status, as long as the AC power is connected.
+12 V	Output when the power is turned ON. Used in the overall device.
+5 V	Output when the power is turned ON. Used in the overall device.
+3.3 V	Output when the power is turned ON. Used in the overall device.
+1.8 V	Output when the power is turned ON. Used as the power to host CPU (LP9).

UR-3956 FRONT I/F Board

Outline of Function

This board is used in a state installed in the monitor main unit MU-651R/671R. Equipped with a remote control receiver and a touch screen controller, and performs relay functions between each board of the front panel and the MAIN DIGITAL board (UR-3945).


UR-3956
MAIN DIGITAL (UR-3945)
CN101
IR Receiver
Touch Screen Controller
CN102
CN103
CN104
CN105
CN106
CN107
POWER SW (UR-3953)
RECORD KEY (UR-3984)
OPERATION (UR-3954)
TOUCH PANEL IF (UR-3983)
INVERTER BD
ALARM (UR-3955)

Explanation of Each Circuit Block Operations

- Remote Control Receiver

  Remote Control Optical Receiver: Receives signals from POWER SW (UR-3953) PD201 by a receiver IC (1-chip CPU), and transmits the received data serially to the MAIN DIGITAL board.

- Touch Screen Controller

  Receives touch screen signals by a controller IC, and transmits the coordinate data serially to the MAIN DIGITAL board.

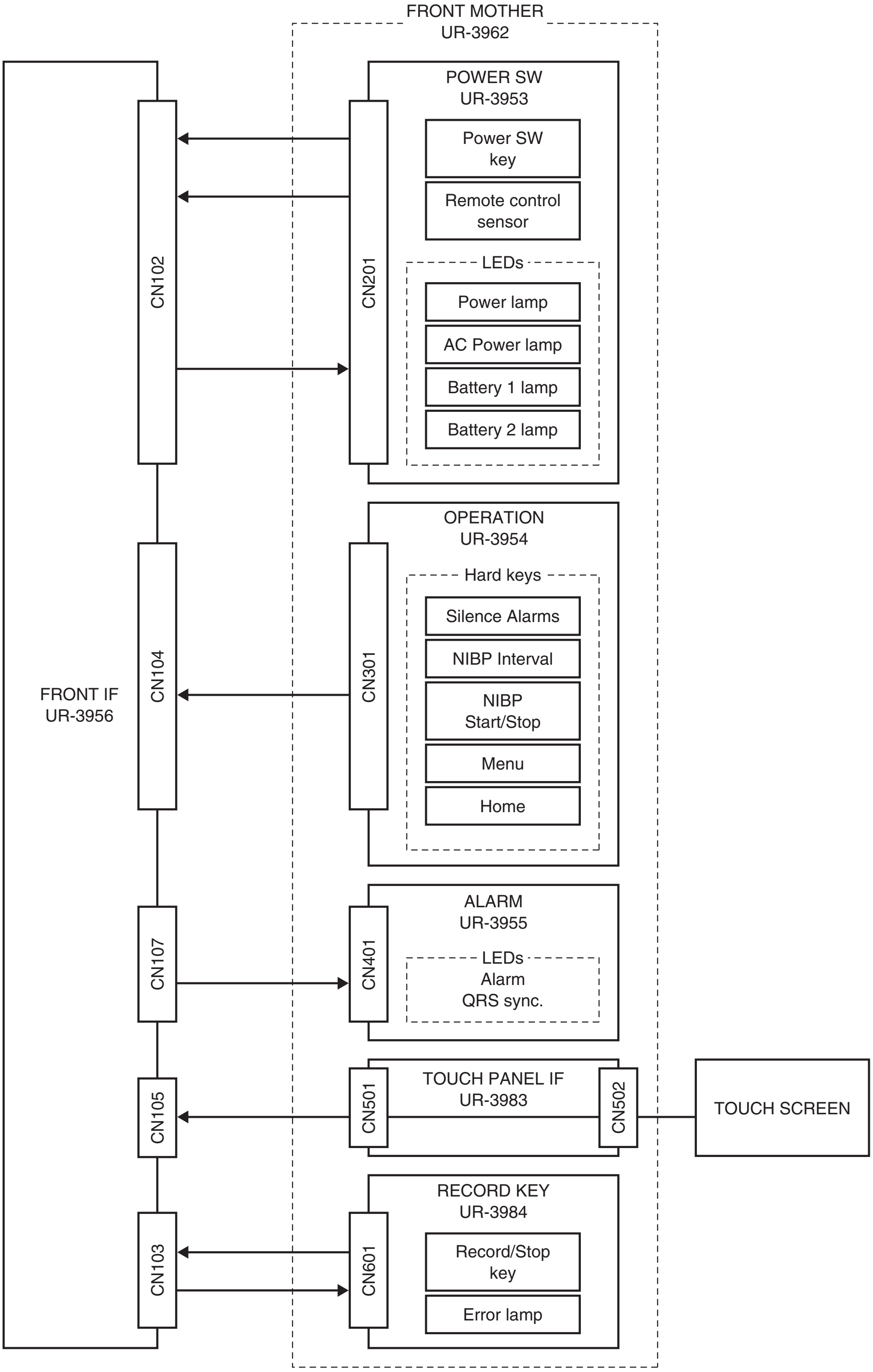
UR-3962 Front Mother Board Set

Outline of Function

This board is used in a state installed in the BSM-6000 series main unit.

This is a composite board composed of the following five boards.

UR-3953	Power SW board
UR-3954	Operation board
UR-3955	Alarm board
UR-3983	TOUCH PANEL I/F board
UR-3984	Record key board


FRONT MOTHER
UR-3962
FRONT IF
UR-3956
CN102
CN104
CN107
CN105
CN103
POWER SW
UR-3953
CN201
Power SW key
Remote control sensor
LEDs
Power lamp
AC Power lamp
Battery 1 lamp
Battery 2 lamp
OPERATION
UR-3954
CN301
Hard keys
Silence Alarms
NIBP Interval
NIBP Start/Stop
Menu
Home
ALARM
UR-3955
CN401
LEDs
Alarm
QRS sync.
TOUCH PANEL IF
UR-3983
CN501
CN502
TOUCH SCREEN
RECORD KEY
UR-3984
CN601
Record/Stop key
Error lamp

Explanation of Each Circuit Block Operations

1. Power SW board (UR-3953)
   Equipped with 1 key switch, 4 LEDs, and a remote control optical receiver module, and conducts power ON/OFF, reception of remote control signals, and indication of the power status.

2. Operation board (UR-3954)
   Equipped with 5 key switches, and detects pressing of the switches.

3. Alarm board (UR-3955)
   Equipped with 9 red LEDs, 9 yellow LEDs, 4 cyan LEDs, and 4 green LEDs, which light/blink according to the alarm information and the heart rate synchronous signals.

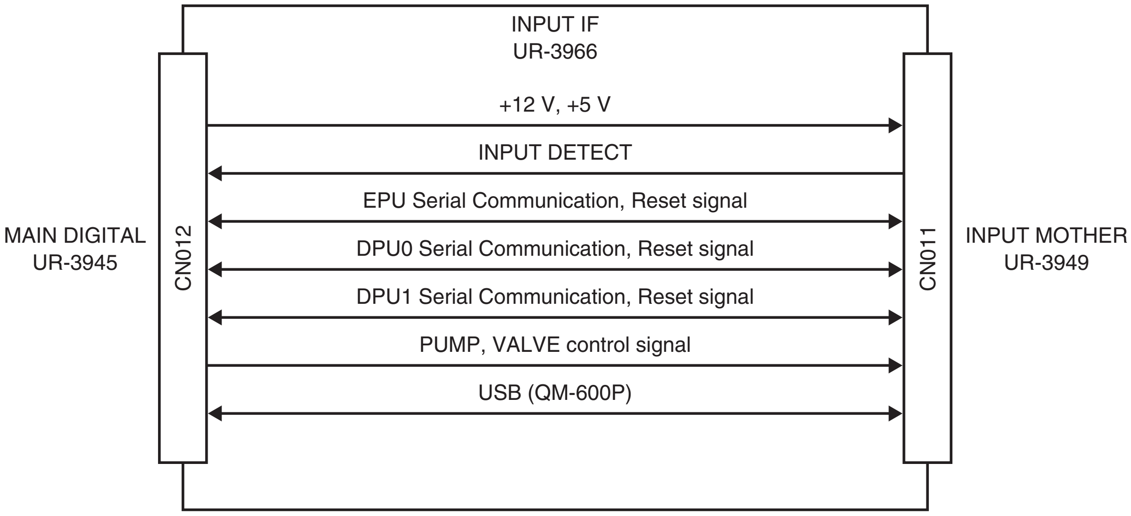
4. TOUCH PANEL I/F board (UR-3983)
   Interface board between the FRONT IF board (UR-3956) and the touch screen.

5. Record key board (UR-3984)
   Equipped with 1 key switch and 1 LED, and conducts recording start/stop, and indicates the detection of paper empty and magazine open/closed status.

UR-3966 INPUT I/F Board

Outline of Function

This is an interface board between the bedside monitor BSM-6000 series MAIN DIGITAL board and the input unit AY-600P series, and used in a state installed in the monitor main unit.


INPUT IF
UR-3966
+12 V, +5 V
INPUT DETECT
EPU Serial Communication, Reset signal
DPU0 Serial Communication, Reset signal
DPU1 Serial Communication, Reset signal
PUMP, VALVE control signal
USB (QM-600P)
MAIN DIGITAL
UR-3945
CN012
CN011
INPUT MOTHER
UR-3949

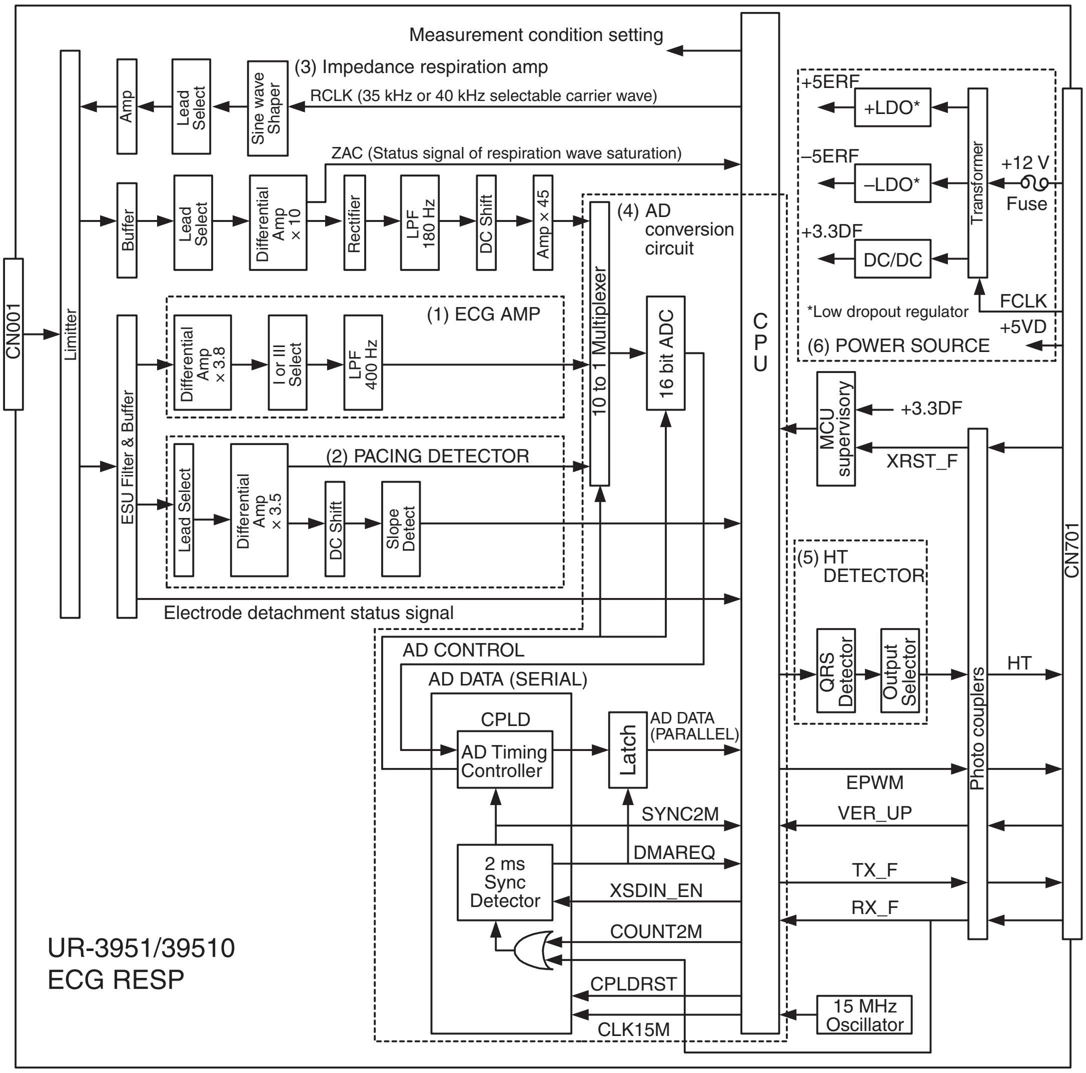
UR-3951/39510 ECG RESP Board

Outline of Function

This board is installed in the input unit, and conducts the primary process of the electrocardiogram and the impedance respiration waveform.

Performs asynchronous serial communication with the monitor main unit, and transmits the waveform data status and receives measurement settings and others. CN001 is connected to UR-3950/39500 (ECG connector board), and functions as the input block for biological signals.

CN701 is connected to UR-3949/39490 (AY MOTHER (INPUT MOTHER) board), and functions as the input/output block for communication with the monitor main unit.


Measurement condition setting
(3) Impedance respiration amp
Amp
Lead Select
Sine wave Shaper
RCLK (35 kHz or 40 kHz selectable carrier wave)
ZAC (Status signal of respiration wave saturation)
Buffer
Lead Select
Differential Amp × 10
Rectifier
LPF 180 Hz
DC Shift
Amp × 45
(4) AD conversion circuit
CN001
Limitter
ESU Filter & Buffer
(1) ECG AMP
Differential Amp × 3.8
I or III Select
LPF 400 Hz
10 to 1 Multiplexer
16 bit ADC
(2) PACING DETECTOR
Lead Select
Differential Amp × 3.5
DC Shift
Slope Detect
Electrode detachment status signal
AD CONTROL
AD DATA (SERIAL)
CPLD
AD Timing Controller
Latch
AD DATA (PARALLEL)
SYNC2M
DMAREQ
2 ms Sync Detector
XSDIN_EN
COUNT2M
CPLDRST
CLK15M
UR-3951/39510
ECG RESP
CPU
+5ERF
+LDO*
–5ERF
–LDO*
+3.3DF
DC/DC
Transformer
+12 V
Fuse
FCLK
+5VD
*Low dropout regulator
(6) POWER SOURCE
MCU supervisory
+3.3DF
XRST_F
(5) HT DETECTOR
QRS Detector
Output Selector
HT
Photo couplers
CN701
EPWM
VER_UP
TX_F
RX_F
15 MHz Oscillator

Explanation of Each Circuit Block Operations

(1) ECG AMP

Performs the analog process of ECG waveforms.

- Differential Amp ×3.8

  I, II, III, V1, V2, V3, V4, V5, V6 lead 3.8 times differential amplifier (9 channels in total)

- I or III Select

  Selects either I lead or III lead.

- LPF 400 Hz
  400 Hz –3 dB low-pass filter

(2) PACING DETECTOR

Detects the waveforms defined in ANSI/AAMI EC13 4.1.4.

- Lead Select
  UR-3951: Selects any one of the standard 12 leads.
  UR-39510: Selects any one of the 8 leads.
- Differential Amp ×3.5
  3.5 times differential amplifier (DC gain is 1 time)
- DC Shift
  Cancels polarizing potential.
- Slope Detect
  Detects waveforms which passed through the differentiating circuit as pacing.

(3) Impedance respiration amp

Performs generation of respiration carrier and analog processing of impedance respiration.

- Sine Shaper
  Forms sine waves from the CPU carrier clock.
- Lead Select
  Selects either R-F lead or R-L lead.
- Differential Amp ×10
  Differentially amplifies 30 to 40 kHz signals by 10 times.
- Rectifier
  Modulated wave rectifier
- LPF 180 Hz
  Demodulator (180 Hz –3 dB low-pass filter)
- DC Shift
  Cancels DC potential after demodulation.
- Amp ×45
  Amplifies respiratory variation by 45 times.

(4) AD conversion circuit

Performs AD conversion in synchronization with signals received from the monitor main unit.

The converted data is output to CPU in the order of upper 8 bits, and then lower 8 bits.

- 10 to 1 Multiplexer
  Converts the analog waveforms of ECG 8 ch, RESP 1 ch, and PACING 1 ch (10 channels in total) into 1ch time-division data.
- 16 bit ADC
  Sampling rate: 8 ksps per channel
  Input range/resolution
  ECG: ± 655 mV/20 uV
  RESP: 163.84 Ω /2.5 m Ω
  PACING: ± 714 mV/22 uV
- AD Timing Controller
  Generates 10 to 1 Multiplexer conversion signals and AD control signals.

- 2 ms Sync Detector
  Generates 2 ms synchronous signals received from the monitor main unit.
- Latch
  8-bit D flip-flop
  Parallel output AD data in the order of upper 8 bits, and then lower 8 bits.

(5) HT DETECTOR

Generates pulses synchronous with R wave, from the ECG waveforms primarily processed by CPU.

- QRS Detector
  Detects waveforms, which passes through the 10 to 20 Hz band-pass filter, as QRS.
- Output Selector
  Selects width and polarity of detected pulse.

(6) POWER SOURCE

Generates power supply by use, from the power supplied from the monitor main unit.

- Transformer
  Power transformer used for insulation of patient circuit
  Winding ratio of primary:secondary = 11:6
- +LDO
  Positive power supply for analog
  +5.26 V ± 3.4%
- –LDO
  Negative power supply for analog
  –5 V ± 5%
- DC/DC
  Power supply for digital
  +3.3 V ± 5%

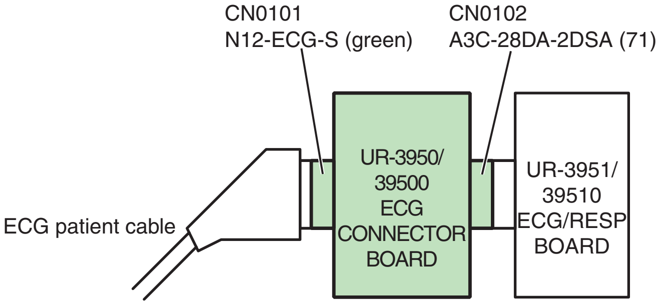
UR-3950/39500 ECG Connector Board

Outline of Function

This board is installed in the input unit, and functions as the interface between the ECG lead wires and UR-3951/39510 (ECG/RESP).

Protective resistance against DEF is installed, and the separation between lead signals is secured by the slits and its structure.

This resistance forms the capacitor and the filter of UR-3951/39510.



UR-39370/39371/39373 Multi Parameter Unit Board (MPU Board)

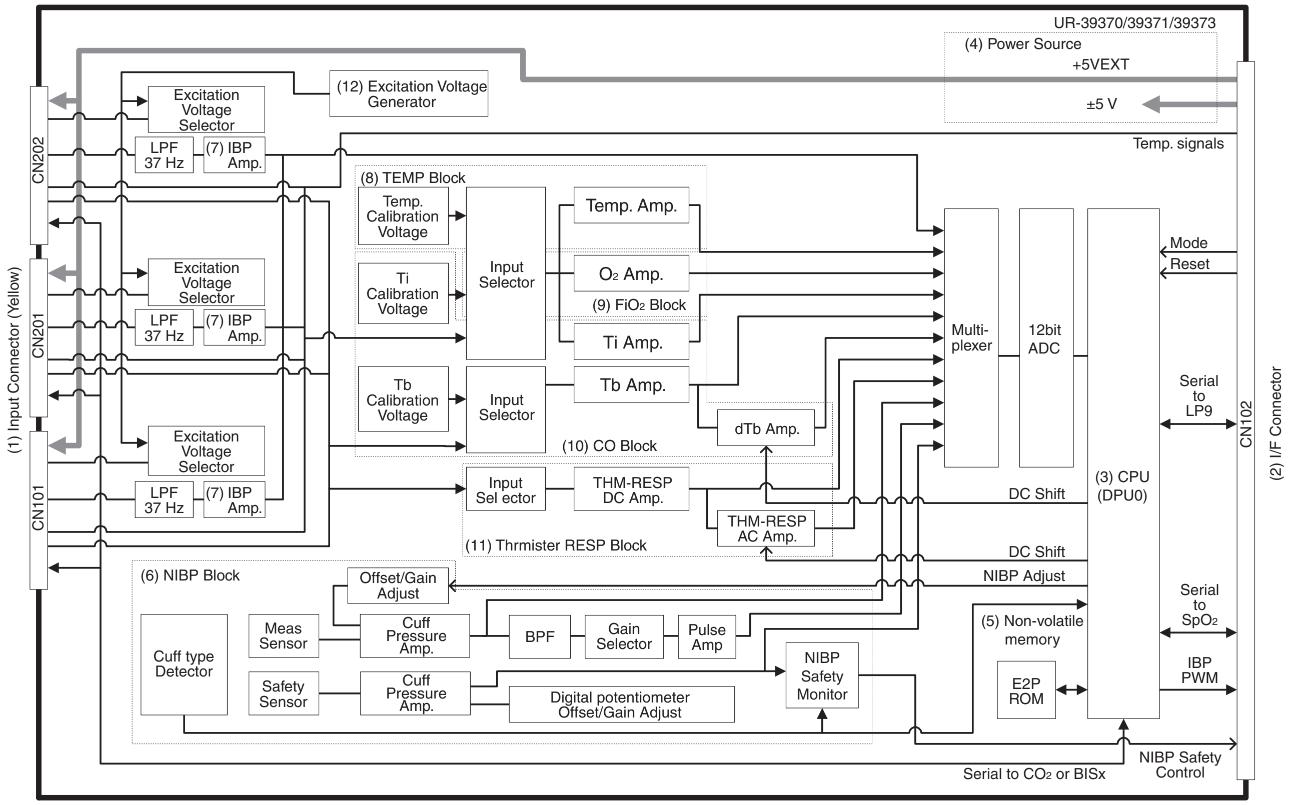
Outline of Function

This board is installed in the input unit, and conducts the primary process of the input signals of NIBP, IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration.

This board also performs asynchronous serial communication with SpO_2, CO_2, and BISx, and acquires waveforms, numeric data, and sensor status. This board performs asynchronous serial communication with the monitor main unit, and transmits these parameters of waveforms/numeric data/status, and receives measurement settings and others.

This board has an NIBP pressure sensor, and performs measurement of cuff pressures and pulse waves. CN101/CN201/CN202 function as the input block of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration, and have a CO_2/BISx asynchronous serial communication line.

For UR-39370/39371, only CN201 (among the three connectors) is installed. CN102 is connected to UR-3940/39400 (TEMP board). This connector functions as the input/output block for communication with the monitor main unit, as well as functions as the input block for the temperature input signal 2 ch from the temperature connector mounted on UR-3940/39400, and functions as the input/output block for asynchronous serial communication with the SpO_2 module incorporated in AY. The power to this board is supplied via this connector.


UR-39370/39371/39373
(4) Power Source
+5VEXT
±5 V
Temp. signals
(12) Excitation Voltage Generator
Excitation Voltage Selector
LPF 37 Hz
(7) IBP Amp.
CN202
CN201
CN101
(1) Input Connector (Yellow)
(8) TEMP Block
Temp. Calibration Voltage
Ti Calibration Voltage
Tb Calibration Voltage
Input Selector
Temp. Amp.
O2 Amp.
(9) FiO2 Block
Ti Amp.
Tb Amp.
dTb Amp.
(10) CO Block
Input Sel ector
THM-RESP DC Amp.
THM-RESP AC Amp.
(11) Thrmister RESP Block
Multi-plexer
12bit ADC
(3) CPU (DPU0)
Mode
Reset
Serial to LP9
CN102
(2) I/F Connector
DC Shift
DC Shift
NIBP Adjust
(5) Non-volatile memory
E2P ROM
Serial to SpO2
IBP PWM
NIBP Safety Control
Serial to CO2 or BISx
(6) NIBP Block
Offset/Gain Adjust
Cuff type Detector
Meas Sensor
Safety Sensor
Cuff Pressure Amp.
Cuff Pressure Amp.
BPF
Gain Selector
Pulse Amp
NIBP Safety Monitor
Digital potentiometer Offset/Gain Adjust

Explanation of Each Circuit Block Operations

(1) Input Connector (CN101, CN201, CN202)

All connectors have the same function as the input/output block for the following signals.

- Exciter voltage output for sensor
- IBP transducer differential signal input
- Analog signal input 2 channels (for temperature, CO, thermistor respiration, and FiO_2 sensor)
- Asynchronous serial communication 1 channel (for CO_2, BISx, and other external modules)
- I^2C bus 1 channel (for identification of sensor type)
- +5 V output (power to sensor)

(2) I/F Connector

Connector to be connected to TEMP board (UR-3940/39400), and functions as the input/output block for the following signals.

- Asynchronous serial communication with the main CPU (DPU0) on this board and LP9
- Asynchronous serial communication with the SpO_2 module built in the AY series input unit
- Input of internal circuit ± 5 V power supply and input of sensor/external module +5 VEXT
- Temperature input 2 channels (for input of UR-3940 temperature dedicated connector)
- NIBP safety circuit output (pump/solenoid valve power supply control)
- Input of reset signal of the main CPU on this board
- Output of PWM signal for IBP analog output signal

(3) CPU (DPU0)

Main CPU of this board (hereinafter referred to as DPU0). Major features are listed below.

- AD converter control
- Input channel control
- Exciter output voltage control
- Sensor identification
- Asynchronous serial communication with CO_2, BISx and other external module and the SpO_2 module built in the AY series input unit
- Asynchronous serial communication with LP9
- Detection of disconnection of each transducer and sensor
- NIBP amplifier (for measurement) gain/offset control
- Function of DC component removal for dTb and thermistor respiration
- IBP decimation (12 bit → 14 bit)
- IBP PWM signal output (for analog output)
- Monitoring of external output power supply (+5 VEXT)
- Monitoring of calibration voltage

(4) Power Source

The following powers are supplied to this board.

- +5 V: Power for internal analog/digital circuits
- –5 V: Power for internal analog circuits
- +5 VEXT: Power for the sensor connection cable E2PROM and external modules

(5) Non-volatile Memory

In this memory the following information is written and stored in the production process.

DPU0 reads this information at the time of startup.

- NIBP gain/offset control information
- IBP gain/offset control information (by channel)
- Hardware identification information

(6) NIBP Block

NIBP circuit is divided into the NIBP measurement circuit and the safety circuit. The safety circuit works separately from other circuits to monitor excessive pressure and long-time pressure application.

NIBP measurement circuit

- MEAS Sensor
  Pressure sensor for measurement of counter pulsatile oscillations
- Cuff Pressure Amp
  Amplifies output of the pressure sensor. The output of this amplifier is treated as the pressure within the cuff.

Gain:	31 times (approximately)
Dynamic range:	300 mmHg or over
Sensitivity:	0.125 mmHg/LSB

- Offset/Gain Adjust
  DPU0 controls the offset and the gain. Adjustment is performed in the production process, and the adjusted values are written and stored in E2PROM on this board. DPU0 uses the adjusted values read at the time of startup, and controls the gain and offset. Thus, the pressure within the cuff is set to work in the dynamic range and sensitivity as shown above.
- BPF, Gain selector, Amplification circuit for counter pulsatile oscillation signal amplifies the small electric signal of the counter pulsatile oscillation obtained with the pressure sensor by passing it through the Band Pass Filter. The output is treated as the pulse wave.

Center frequency:	2 Hz (approximately)
Gain (after cuff pressure amplification):	11 times, 61 times, 41.5 times, 302 times

Safety circuit

- Safety Sensor
  Pressure sensor for safety monitoring
- Cuff Pressure Amp
  Amplifies output of the pressure sensor for safety monitoring. The output of this amplifier is AD-converted by the AD converter on this board and the AD converter built in the safety monitoring CPU (NIBP Safety Monitor).
  Gain: 33.4 times (approximately)
  Dynamic range: 330 mmHg or over
  Sensitivity: 0.117 mmHg/LSB (12 bit: DPU0), 0.489 mmHg/LSB (10 bit: NIBP Safety Monitor)
- NIBP Safety Monitor
  Monitors output of the safety monitoring sensor by the built-in AD. Stops applying voltage to the pump and the solenoid valve according to the conditions below, and discharge the air inside of the cuff.
  - When an excessive pressure is applied,
    Cuff for adults and children: 300 mmHg or over
    Cuff for neonates: 150 mmHg or over
  - Measurement time
    Cuff for adults and children: Within 180 seconds
    Cuff for neonates: Within 90 seconds
  - Time interval in interval measurement:
    Less than 30 seconds interval of time between measurement

(7) IBP Amp.

Each input connector is equipped with an instrumentation amplifier.

Gain: 156 times (approximately)
Dynamic range: ±500 mmHg or over
Sensitivity: 0.25 mmHg/LSB (ADC output), 0.0125 mmHg/LSB (DPU0 output)
Cutoff frequency: 37 Hz (approximately)

(8) TEMP Block

Periodically switches and amplifies the input of all connectors including the temperature dedicated connector on UR-3940/39400. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 13.1 times (approximately)

(9) O_2 Block

Periodically switches and amplifies the input of all connectors. Also periodically inputs the calibration signals and corrects the offset voltage of the amplifier.

Gain: 19.6 times (approximately)
Sensitivity: 0.073%O_2/LSB

(10) CO block

CO block consists of the injectate temperature (Ti) amplifier, blood temperature (Tb) amplifier, and Δ Tb amplifier.

- Ti Amp.
  Periodically switches and amplifies the input of all connectors. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.
  Gain: 4 times (approximately)
- Tb Amp.
  Amplifies the signals input from the connector to the IBP connection cable. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier. Gain: 82.4 times (approximately)
- dTb Amp.
  Amplifies output of Tb Amp. DC components are removed by the DPU0 timer output.

Gain:	10 times
Frequency response:	DC to 12 Hz (–3 dB)

(11) Thermistor RESP Block

Thermistor respiration amplifier has a double-stage structure consisting of a DC amplifier and an AC amplifier. In the AC amplifier, DC components are removed by the DPU0 DA output.

Gain: DC amplifier: 41.4 times (approximately)
AC amplifier: 24 times (approximately)

(12) Excitation Voltage Generator

Generates excitation voltage as shown below for the transducer and thermistor sensor. Excitation voltage is switched depending on the connected sensor and output.

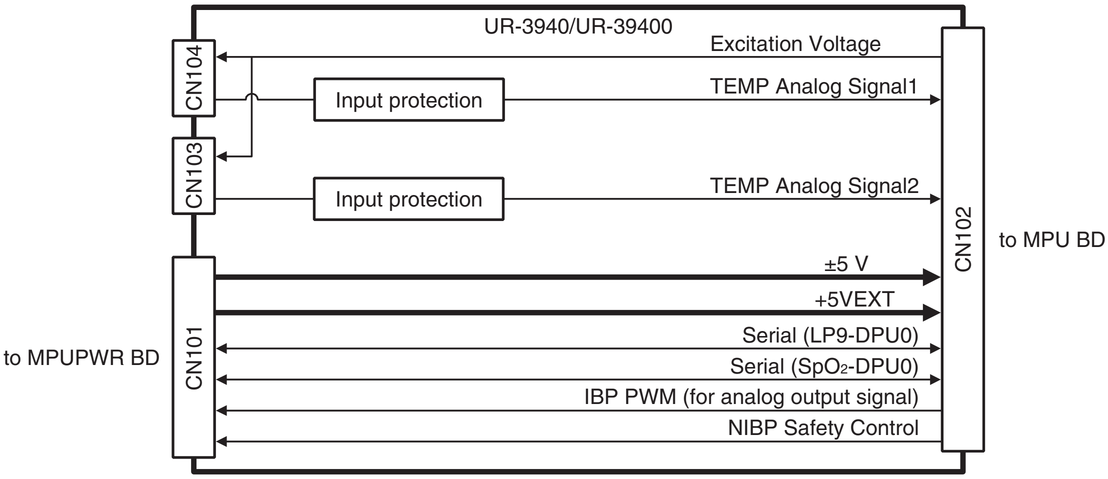
• IBP:	4.096 V
• Temperature:	0.5 V
• CO, Thermistor respiration:	2.5 V

UR-3940/39400 TEMP Board

Outline of Function

This board is installed in the input unit (AY-600P series), and is connected to the MPU board (UR-39370/39371/39373) and MPU PWR board (UR-3938/39380/3972/39721). This board functions as the physical interface for MPU board power supply and analog output IBP PWM signals, as well as the physical interface of asynchronous serial communication between MPU board and LP9 and asynchronous serial communication between MPU board and SpO_2 unit.

This board also has two input connectors for dedicated use for temperature input, and the temperature signals input from these connectors are transmitted to the MPU board.


UR-3940/UR-39400
CN104
CN103
CN101
CN102
Excitation Voltage
Input protection
TEMP Analog Signal1
Input protection
TEMP Analog Signal2
±5 V
+5VEXT
Serial (LP9-DPU0)
Serial (SpO2-DPU0)
IBP PWM (for analog output signal)
NIBP Safety Control
to MPU BD
to MPUPWR BD

UR-3938/39380/3972/39721 Multi Parameter Unit Power Board

Outline of Function

This board is installed in the input unit (AY-600P series), and is connected to the TEMP board (UR-3940/39400) and AY MOTHER (INPUT MOTHER) board (UR-3949/39490). This board also has a connector to the SpO_2 module and the SpO_2 input connector. In addition, it is equipped with an analog output connector.

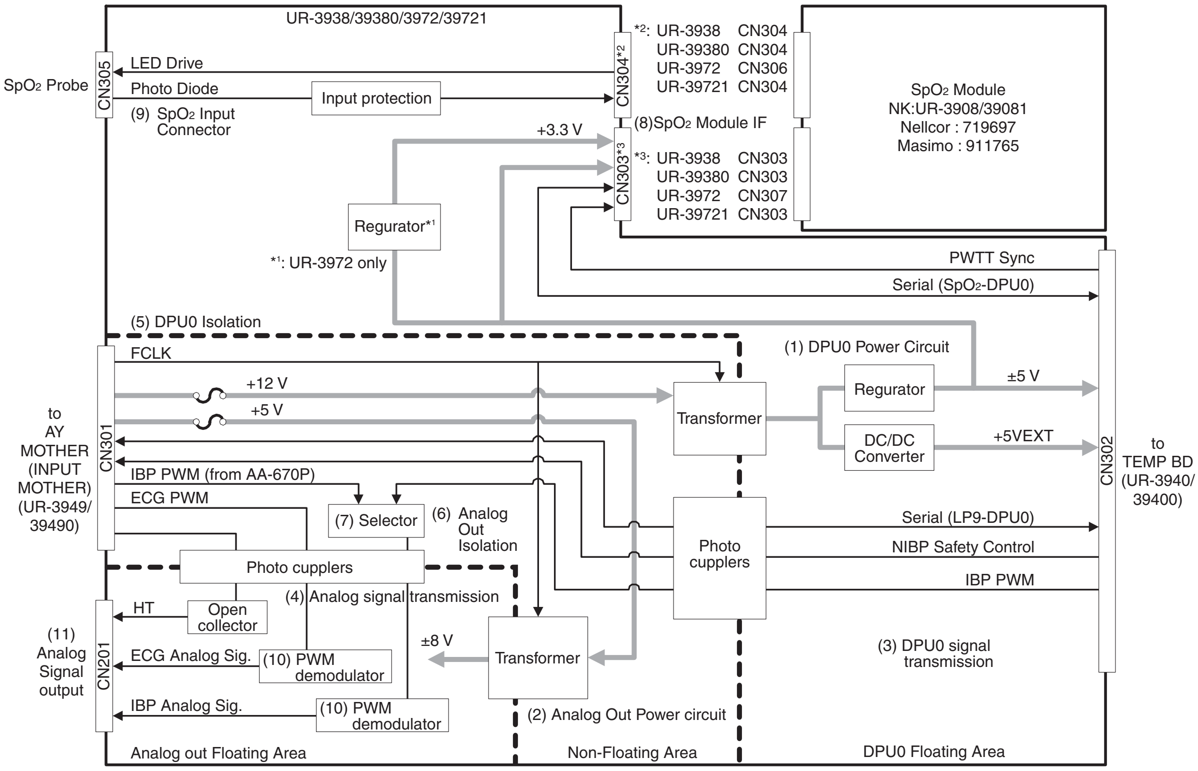
This board has the following functions:

- Generation of the DPU0 floating power supply
- Transmission of signals between this floating power supply and the ground
- SpO_2 module interface
- Generation of the floating power supply for analog output
- Transmission of signals between this floating power supply and the ground
- Demodulation of PWM signals for analog output

The patient circuit is isolated by this board. The analog output block is also floated and electrically isolated from the other devices.

The model name of this board differs depending on the type of the SpO_2 module to be connected, as shown below.

NK SpO_2:	UR-3938/39380
Nellcor:	UR-3972
Masimo:	UR-39721


UR-3938/39380/3972/39721
SpO2 Probe
CN305
LED Drive
Photo Diode
Input protection
(9) SpO2 Input Connector
CN304*2
*2: UR-3938 CN304
UR-39380 CN304
UR-3972 CN306
UR-39721 CN304
(8)SpO2 Module IF
+3.3 V
CN303*3
*3: UR-3938 CN303
UR-39380 CN303
UR-3972 CN307
UR-39721 CN303
SpO2 Module
NK:UR-3908/39081
Nellcor : 719697
Masimo : 911765
Regurator*1
*1: UR-3972 only
PWTT Sync
Serial (SpO2-DPU0)
(5) DPU0 Isolation
FCLK
(1) DPU0 Power Circuit
+12 V
+5 V
Transformer
Regurator
±5 V
DC/DC Converter
+5VEXT
to AY MOTHER (INPUT MOTHER) (UR-3949/ 39490)
CN301
IBP PWM (from AA-670P)
ECG PWM
(7) Selector
(6) Analog Out Isolation
Photo cupplers
Serial (LP9-DPU0)
NIBP Safety Control
IBP PWM
CN302
to TEMP BD (UR-3940/ 39400)
Photo cupplers
(4) Analog signal transmission
HT
Open collector
(11) Analog Signal output
CN201
ECG Analog Sig.
(10) PWM demodulator
±8 V
Transformer
(3) DPU0 signal transmission
IBP Analog Sig.
(10) PWM demodulator
(2) Analog Out Power circuit
Analog out Floating Area
Non-Floating Area
DPU0 Floating Area

Explanation of Each Circuit Block Operations

(1) DPU0 Power Circuit

Generates the DPU0 floating power supply from +12 V supplied from AY MOTHER (INPUT MOTHER) board (UR-3949/39490) by switching the transformer with FCLK.

- ±5 V
  Usage: DPU0 floating internal circuit
  Accuracy: ±5%
- +5 VEXT
  Usage: Sensor connection cable E2PROM and external modules (CO_2, BISx, and others)
  Accuracy: ±5%
- +3.3 V (UR-3972 only)
  Usage: Power supply for the Nellcor SpO_2 module

(2) Analog Out Power Circuit

Generates the DPU0 floating power supply from +12 V supplied from INPUT MOTHER board (UR-3949/39490) by switching the transformer with FCLK.

- ±8 V
  Usage: Analog output floating circuit power supply
  Accuracy: +8 V or over, –8 V or under

(3) DPU0 Signal Transmission

Transmits the following signals to the grounding circuit by the photo coupler.

- Asynchronous serial communication between LP9 and DPU0
- IBP PWM signals for analog output
- NIBP safety monitoring circuit output signals
- DPU0 reset/mode signals

(4) Analog Signal Transmission

Transmits the following signals to the analog output floating block by the photo coupler.

- IBP PWM signals
- ECG PWM signals
- HT pulse signals

(5) DPU0 Isolation

Electrically separates the DPU0 patient circuit from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

(6) Analog Out Isolation

Electrically separates the analog output block from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

(7) IBP PWM Selector

As the analog output IBP PWM signals, either the AY DPU0 output or the AA DPU1 output is selected and output.

(8) SpO_2 Module IF

Transmits the input signal from the SpO_2 input connector (CN305) mounted on this board to the SpO_2 module. SpO_2 module transmits the digital signals including waveform information, numeric information, and status information from CN302 to TEMP board. It also supplies +5 V power supply generated by this board to the SpO_2 module. However for the Nellcor SpO_2 module, separately generates +3.3 V and supply it along with +5 V. In addition, transmits the PWTT synchronous signals output from DPU0 to the NK SpO_2 module.

(9) SpO_2 Input Connector (CN305)

Outputs the LED-driving signals for the SpO_2 probe, and inputs the photodiode signals from the SpO_2 probe.

(10)PWM Demodulator

Demodulates IBP PWM signals and ECG PWM signals for analog signals.

(11)Analog Signal Output (CN201)

Outputs the following signals.

- ECG analog signal

Sensitivity:	1 V/1 mV ± 5%
Offset:	Within ± 50 mV
Frequency response (lower range):	0.5 Hz (–3 dB)
Frequency response (higher range):	100 Hz (–3 dB)

- HT pulse

  Open collector output

- IBP analog output

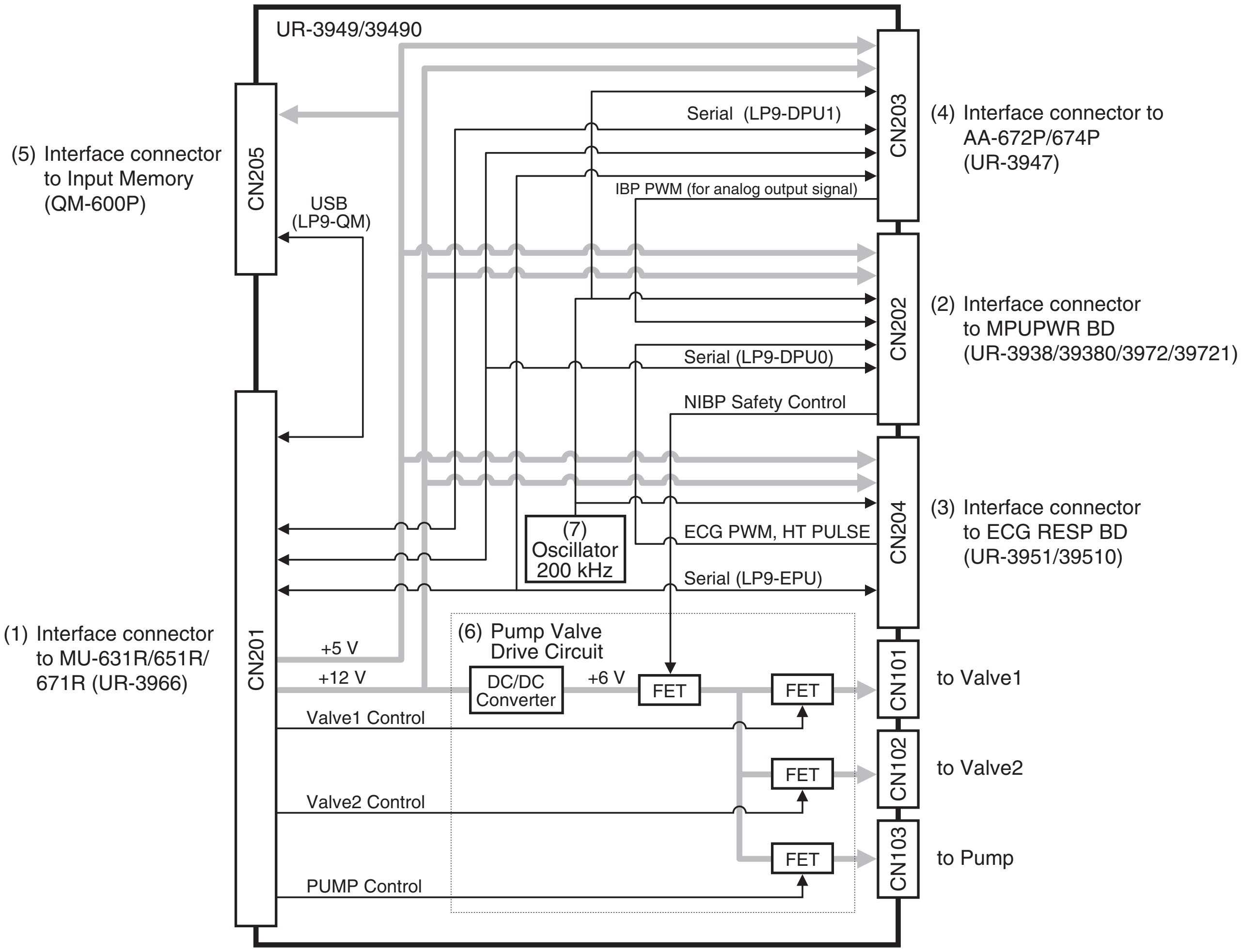
Sensitivity:	1 V/100 mHg ± 1%
Offset:	Within ± 10 mV
Frequency response:	DC to 20 Hz (–3 dB)

UR-3949/39490 AY MOTHER (INPUT MOTHER) Board

Outline of Function

This board is installed in the input unit (AY-600P series). This board is equipped with an interface connector with the MU-631R/MU-651R/MU-671R and AY-600P series, and works as the interface for the asynchronous serial communication between MU-631R/MU-651R/MU-671R and EPU/DPU0. This board is also equipped with an interface connector with AA-600P, and works as the interface for the asynchronous serial communication between MU-631R/MU-651R/MU-671R and DPU1. In addition, by the connector to Input Memory (QM-600P), this board works as the interface for the USB communication between MU-631R/MU-651R/MU-671R and QM-600P.

Besides, this board has the connectors for the NIBP pump and two valves, as well as the power supply circuit and the driving circuit for them, to switch ON/OFF status of the power to the pump and the solenoid valve.


UR-3949/39490
CN205
(5) Interface connector to Input Memory (QM-600P)
USB (LP9-QM)
CN203
Serial (LP9-DPU1)
IBP PWM (for analog output signal)
(4) Interface connector to AA-672P/674P (UR-3947)
CN202
Serial (LP9-DPU0)
NIBP Safety Control
(2) Interface connector to MPUPWR BD (UR-3938/39380/3972/39721)
CN204
ECG PWM, HT PULSE
Serial (LP9-EPU)
(3) Interface connector to ECG RESP BD (UR-3951/39510)
(7) Oscillator 200 kHz
CN201
(1) Interface connector to MU-631R/651R/671R (UR-3966)
+5 V
+12 V
(6) Pump Valve Drive Circuit
DC/DC Converter
+6 V
FET
FET
FET
FET
Valve1 Control
Valve2 Control
PUMP Control
CN101
to Valve1
CN102
to Valve2
CN103
to Pump

Explanation of Each Circuit Block Operations

(1) Interface Connector to MU-631R/MU-651R/MU-671R

Interface connector to MU-631R/MU-651R/MU-671R, and functions as the input/output block for the following signals.

- AY-600P series, AA-672P/674P, and QM-600P power supply (+12 V, +5 V)
- Asynchronous serial communication between LP9 and EPU0
- Asynchronous serial communication between LP9 and DPU0
- Asynchronous serial communication between LP9 and DPU1
- USB communication between LP9 and QM-600P
- NIBP pump and solenoid valve control signals

(2) Interface Connector to MPUPWR board

Interface connector to MPUPWR board, and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and DPU0
- Power output (+12 V, +5 V) for the DPU0 floating block and the analog out floating circuit
- PWM (AA-672P/674P output signals) output for IBP analog output
- PWM output for ECG analog output and HT pulse output
- NIBP safety control signal input
- Clock output for transformer switching

(3) Interface Connector to ECG RESP board

Interface connector to ECG RESP board, and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and EPU
- Power output (+12 V, +5 V) for the EPU floating block
- PWM signal input for ECG analog output and HT pulse input
- Clock output for transformer switching

(4) Interface Connector to AA-672P/674P

Interface connector to AA-672P/674P , and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and DPU1
- Power output (+12 V, +5 V) for the DPU1 floating block
- IBP PWM signal input for analog output
- Clock output for transformer switching

This connector also functions as the input/output block for asynchronous serial communication between LP9 and EPU0, and between LP9 and DPU0, for extensive use in the future.

(5) Interface Connector to Input Memory

Interface connector to QM-600P, and functions as the input/output block for the following signals.

- USB communication between LP9 and QM-600P
- Power output (+5 V) for QM-600P

(6) Pump Valve Drive Circuit

Driving circuit for the pump and the solenoid valve. It has the following functions.

- Generation of +6 V power for the pump and the solenoid valve
- FET for ON/OFF of the pump and the solenoid valve
- FET for safety control

(7) Oscillator

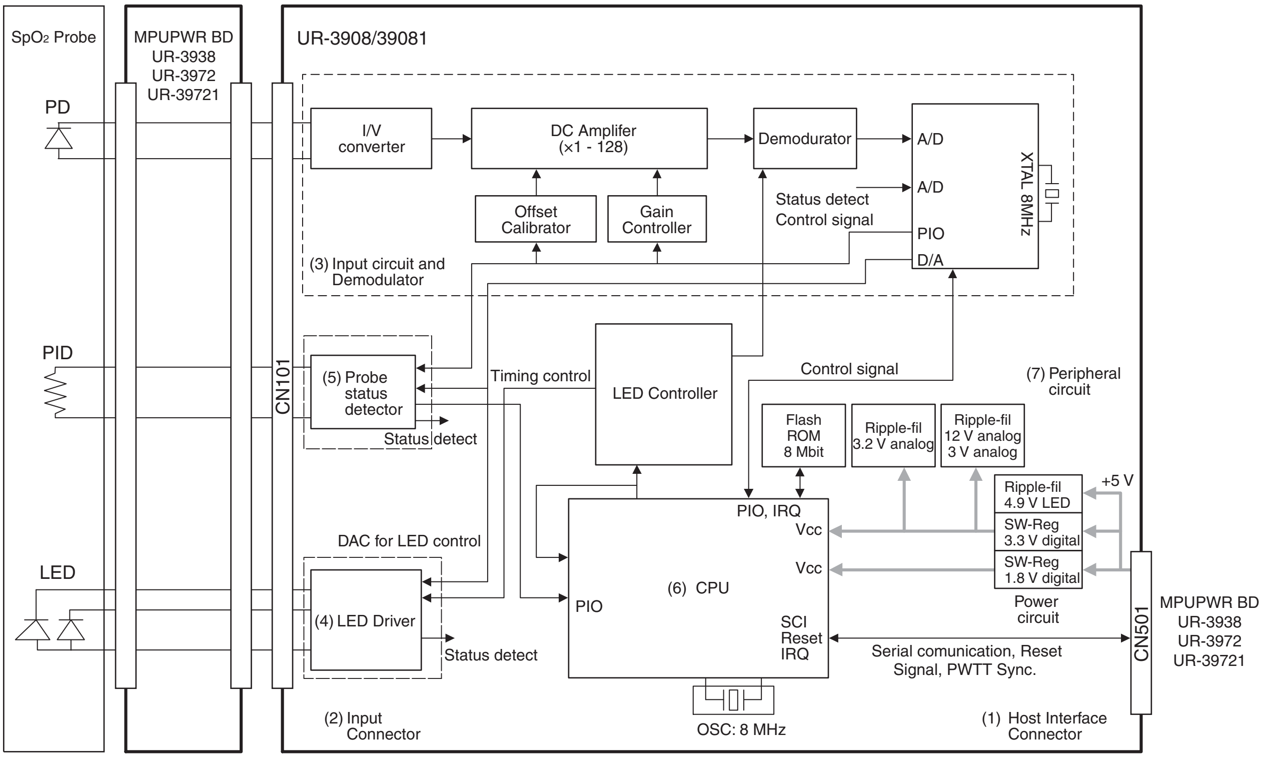
Generates the clock signals for each floating power supply transformer switching.

Oscillating frequency: 200 kHz (approximately)

UR-3908/39081 SpO_2 Board

Outline of Function

This board controls the SpO_2 probe LED status, and performs the photodiode current/voltage conversion, analog signal processing, and A/D conversion in order, to measure SpO_2, pulse rate, etc. and transmit their data in serial signals to the host system.


SpO2 Probe
PD
PID
LED
MPUPWR BD
UR-3938
UR-3972
UR-39721
UR-3908/39081
CN101
I/V converter
DC Amplifer (×1 - 128)
Demodurator
A/D
A/D
PIO
D/A
XTAL 8MHz
Offset Calibrator
Gain Controller
Status detect
Control signal
(3) Input circuit and Demodulator
(5) Probe status detector
Status detect
Timing control
LED Controller
Control signal
(7) Peripheral circuit
Flash ROM 8 Mbit
Ripple-fil 3.2 V analog
Ripple-fil 12 V analog 3 V analog
Ripple-fil 4.9 V LED
SW-Reg 3.3 V digital
SW-Reg 1.8 V digital
+5 V
Power circuit
DAC for LED control
(4) LED Driver
Status detect
PIO, IRQ
Vcc
Vcc
(6) CPU
PIO
SCI
Reset
IRQ
Serial comunication, Reset Signal, PWTT Sync.
CN501
MPUPWR BD
UR-3938
UR-3972
UR-39721
(2) Input Connector
OSC: 8 MHz
(1) Host Interface Connector

Explanation of Each Circuit Block Operations

(1) Host Interface Connector

CN0501 connector passes serial communication signals of DPU0 and receives power from MPUPWR BD.

(2) Input Connector

CN0101 is a connector for the sensor. This connector passes signals of the connection cord and sensor.

(3) Input Circuit and Demodulator

- I/V conversion circuit: Converts the PD output signals to voltage.
- DC amplifier: Amplifies the differential components of input signals in eight steps by an external control.
- Demodulation circuit: Demodulates the red light and infrared light components received as time-series pulses.
- A/D: A/D-converts the demodulated red light and infrared light pulse signals.

(4) LED Driver

- Sets the amount of light by the LED-driving external control, and blinks the probe LED in synchronized timing.
  Resolution: 0.3 mA/LSB (80 mA/255 LSB)
- Detects short circuit on R or IR_LED by having A/D conversion on IR_LED luminescence signals.

(5) Probe Status Detector

- Probe ID detector
  Detects the probe ID by the ID identification resistance built in the probe.
- Shield disconnection detector
  Detects a shield disconnection via the input parallel I/O built in CPU.
- Detector of connection cord insertion/removal status
  Identifies whether the connection cord is inserted or removed via the input parallel I/O built in CPU.

(6) CPU

Calculate SpO_2 and PR values.
AT91R40008 (ARM7 Core CPU by ATMEL corporation) is used as the CPU that conducts the following jobs necessary for SpO_2 measurement: timing occurrence, LED driving current amount, demodulation timing, measurement status detection, and communication with the host device.
Operating frequency: 64 MHz
SCI 2 ch, SRAM 256 KB incorporated

(7) Peripheral Circuit

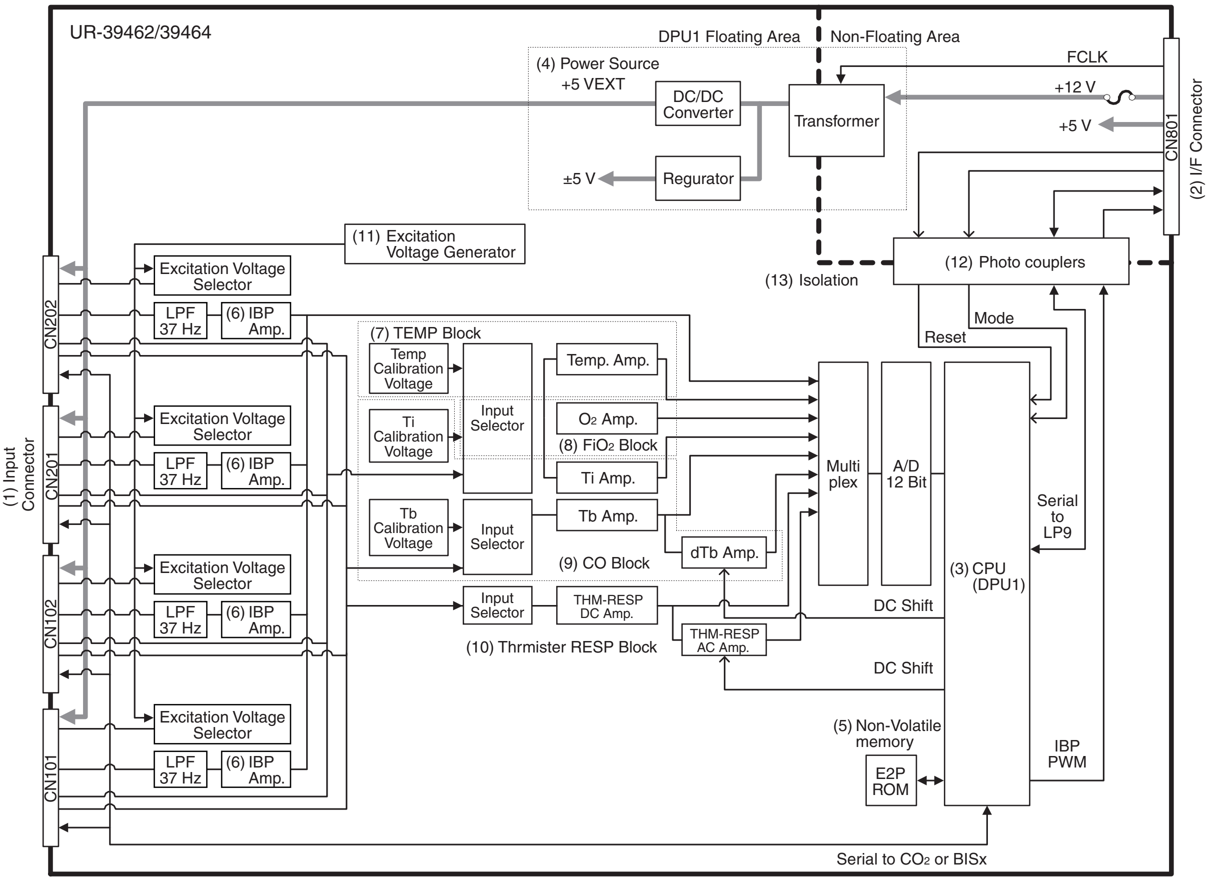
- Power supply circuit
  Generates analog ±3 V/+12 V, digital +3.3 V/+1.8 V from the +5 V power supplied by the host device, by the DC/DC converter and regulator.
- Interface with the host device
  Transmits electronic information via serial communication between the SpO_2 board and host device, also transmits PWTT synchronization reference clock, CPU reset signals, and CPU-built-in flash ROM writing control signals.
- External FLASH
  Accesses the external FLASH (8 Mbit) by the address bus, data bus, and control bus.

UR-39462/39464 External Multi Parameter Unit Board (EXTMPU Board)

Outline of Function

This board is installed in the smart expansion unit, and conducts the primary process of the input signals of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration. This board also performs asynchronous serial communication with CO_2 and BISx, and acquires waveforms, numeric data, and sensor status. This board performs asynchronous serial communication with the monitor main unit, and transmits these parameters of waveforms/numeric data/status, and receives measurement settings and other data.

CN101/CN102/CN201/CN202 function as the input block of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration, and are equipped with the CO_2/BISx asynchronous serial communication line. For UR-39462, only CN102 and CN202 (among the four connectors) are installed. CN801 is connected to UR-3947 (EXTMPU PWR board). This connector functions as the input/output block for communication with the monitor main unit. The power to this board is supplied via this connector.


UR-39462/39464
DPU1 Floating Area
Non-Floating Area
(4) Power Source
+5 VEXT
DC/DC Converter
Transformer
FCLK
+12 V
+5 V
CN801
(2) I/F Connector to UR-3947
±5 V
Regurator
(11) Excitation Voltage Generator
Excitation Voltage Selector
(12) Photo couplers
(13) Isolation
CN202
LPF 37 Hz
(6) IBP Amp.
Mode
Reset
(7) TEMP Block
Temp Calibration Voltage
Input Selector
Temp. Amp.
Ti Calibration Voltage
O2 Amp.
(8) FiO2 Block
Ti Amp.
Multi plex
A/D 12 Bit
Serial to LP9
(1) Input Connector
CN201
Tb Calibration Voltage
Tb Amp.
dTb Amp.
(9) CO Block
(3) CPU (DPU1)
CN102
THM-RESP DC Amp.
DC Shift
THM-RESP AC Amp.
(10) Thrmister RESP Block
DC Shift
(5) Non-Volatile memory
E2P ROM
IBP PWM
CN101
Serial to CO2 or BISx

Explanation of Each Circuit Block Operations

(1) Input Connector (CN101, CN102, CN201, CN202)

All connectors have the same function as the input/output block for the following signals.

- Excitor voltage output for sensor
- IBP transducer differential signal input
- Analog signal input 2 channels (for temperature, CO, thermistor respiration, and FiO_2 sensor)
- Asynchronous serial communication 1 channel (for CO_2, BISx, and other external modules)
- I^2C bus 1 channel (for identification of sensor type)
- +5 V output (power to sensor)

(2) IF Connector

Connector to be connected to EXTMPU PWR board (UR-3947), and functions as the input/output block for the following signals.

- Asynchronous serial communication with the main CPU (DPU1) on this board and LP9
- +12 V power supply, +5 V power supply
- Input of reset signal of the main CPU on this board
- Output of PWM signal for IBP analog output signal

(3) CPU (DPU1)

Main CPU of this board (hereinafter referred to as DPU1*). Major features are listed below.

* DPU1 is operated by the software same as DPU0.

- AD converter control
- Input channel control
- Exciter output voltage control
- Sensor identification
- Asynchronous serial communication with the CO_2, BISx, and other external modules
- Asynchronous serial communication with LP9
- Detection of disconnection of each transducer and sensor
- Function of DC component removal for dTb and thermistor respiration
- IBP decimation (12 bit → 14 bit)
- IBP PWM signal output (for analog output)
- Monitoring of external output power supply (+5 VEXT)
- Monitoring of calibration voltage

(4) Power Source

+12 V and +5 V are supplied to this board, and the following powers are generated by the DC/DC converter and regulator.

- +5 V: Power for DPU1 floating block analog and digital circuits
- –5 V: Power for DPU1 floating block analog circuits
- +5 VEXT: Power for the sensor connection cable E2PROM and external modules

(5) Non-volatile Memory

In this memory the following information is written and stored in the production process.

DPU1 reads this information at the time of startup.

- IBP gain/offset control information (by channel)
- Hardware identification information

(6) IBP Amp.

Each input connector is equipped with an instrumentation amplifier.

Gain: 156 times (approximately)
Dynamic range: ±500 mmHg or over
Sensitivity: 0.25 mmHg/LSB (ADC output), 0.0125 mmHg/LSB (DPU1 output)
Cutoff frequency: 37 Hz (approximately)

(7) TEMP Block

Periodically switches and amplifies the input of all connectors.

Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 13.1 times (approximately)

(8) FiO_2 Block

Periodically switches and amplifies the input of all connectors. Also periodically inputs the calibration signals and corrects the offset voltage of the amplifier.

Gain: 19.6 times (approximately)
Sensitivity: $0.073\%O_2$/LSB

(9) CO block

CO block consists of the injectate temperature (Ti) amplifier, blood temperature (Tb) amplifier, and Δ Tb amplifier.

- Ti Amp.

  Periodically switches and amplifies the input of all connectors. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

  Gain: 4 times (approximately)
- Tb Amp.

  Amplifies the signals input from the connector to the CO sensor connection cable. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

  Gain: 82.4 times (approximately)
- dTb Amp.

  Amplifies output of Tb Amp. DC components are removed by the DPU1 timer output.

  Gain: 10 times
  Frequency response: DC to 12 Hz (–3 dB)

(10)Thermistor RESP Block

Thermistor respiration amplifier has a double-stage structure consisting of a DC amplifier and an AC amplifier.

In the AC amplifier, DC components are removed by the DPU1 DA output.

Gain: DC amplifier: 41.4 times (approximately)
AC amplifier: 24 times (approximately)

(11)Excitation Voltage Generator

Generates excitation voltage as shown below for the transducer and thermistor sensor. Excitation voltage is switched depending on the connected sensor and output.

• IBP:	4.096 V
• Temperature:	0.5 V
• CO, thermistor respiration:	2.5 V

(12)Photo Couplers

Transmits the following signals to the grounding circuit by the photo couplers.

- Asynchronous serial communication between LP9 and DPU1
- IBP PWM signals for analog output
- DPU1 reset/mode signals

(13)Isolation

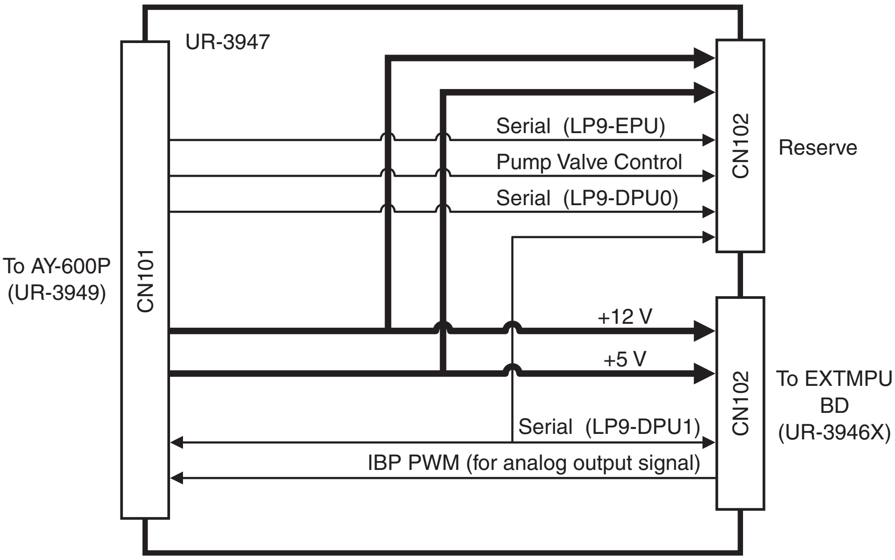
Electrically isolates the DPU1 isolation circuit from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

UR-3947 External Multi Parameter Unit Connection Board

Outline of Function

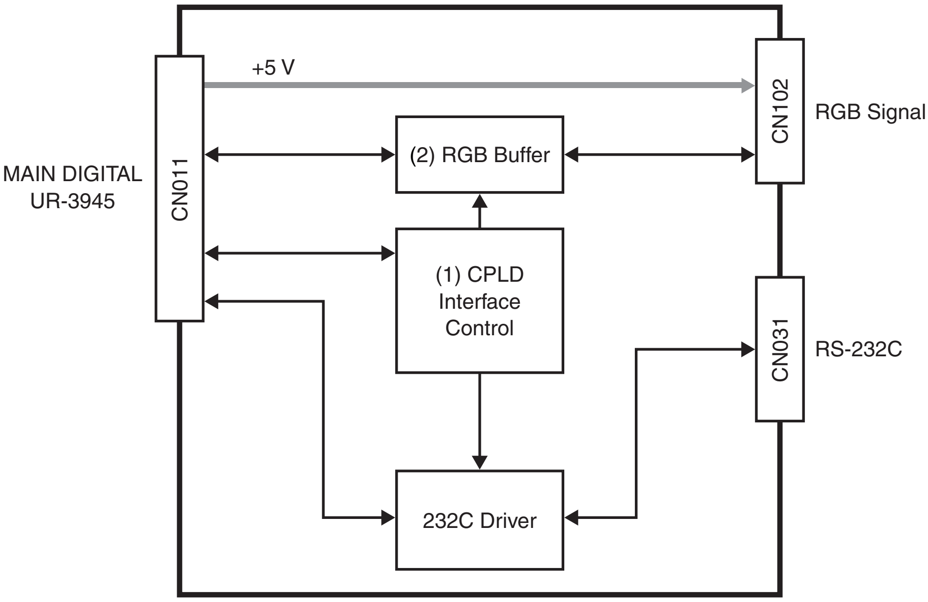
This board is installed in the smart expansion unit (AA-670P series), and is connected to EXTMPU board (UR-39462/39464). This board functions as the physical interface for EXTMPU board power supply, as well as the physical interface of asynchronous serial communication between DPU1 and LP9.


UR-3947
To AY-600P
(UR-3949)
CN101
Serial (LP9-EPU)
Pump Valve Control
Serial (LP9-DPU0)
CN102
Reserve
+12 V
+5 V
Serial (LP9-DPU1)
IBP PWM (for analog output signal)
CN102
To EXTMPU
BD
(UR-3946X)

QI-631P Interface (MIX)

Outline of Function

The interface (QI-631P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with the RGB output and RS-232C.


+5 V
MAIN DIGITAL
UR-3945
CN011
(2) RGB Buffer
(1) CPLD
Interface
Control
232C Driver
CN102
RGB Signal
CN031
RS-232C

Explanation of Each Circuit Block Operation

(1) Communication Control (CPLD)
Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

(2) RGB Buffer Circuit
Buffers the analog RGB signals from the monitor main unit MAIN DIGITAL board, and output them externally.

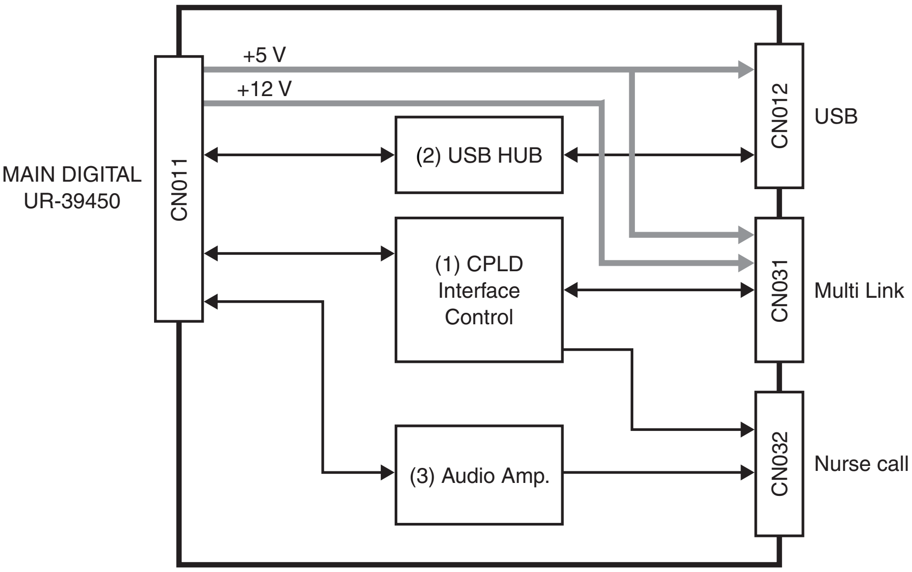
Also controls the +5 V power supply by the power supply control signals from the communication controller.

(3) Output Voltage
RGB +5 V ± 5% (load current 200 mA)

QI-632P Interface (ML)

Outline of Function

The interface (QI-632P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with USB, multi link and nurse call.



Explanation of Each Circuit Block Operation

(1) Communication Control (CPLD)
Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

In addition, this is equipped with the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

(2) USB Hub Controller
Relays the USB signals from the monitor main unit MAIN DIGITAL board.

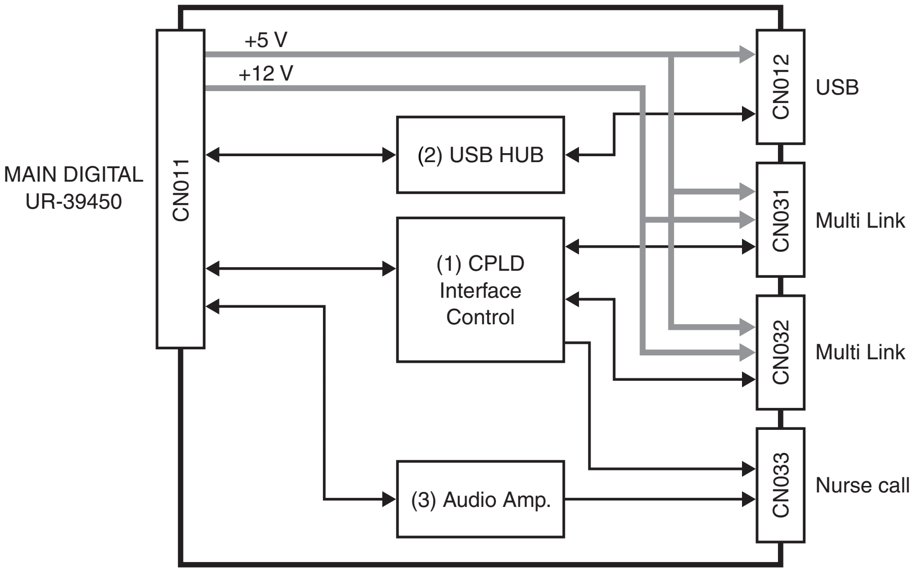
(3) Sound Circuit
Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.

(4) Output Voltage
Multi link communication +12 V ± 5% (load current 500 mA)
Multi link communication +5 V ± 5% (load current 200 mA)
USB +5 V ± 5% (load current 500 mA)

QI-634P Interface

Outline of Function

The interface (QI-634P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with USB, multi link and nurse call.


+5 V
+12 V
MAIN DIGITAL
UR-39450
CN011
(2) USB HUB
(1) CPLD
Interface
Control
(3) Audio Amp.
CN012
USB
CN031
Multi Link
CN032
Multi Link
CN033
Nurse call

Explanation of Each Circuit Block Operations

(1) Communication Control (CPLD)
Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

In addition, this board has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

(2) USB Hub Controller
Relays the USB signals from the monitor main unit MAIN DIGITAL board.

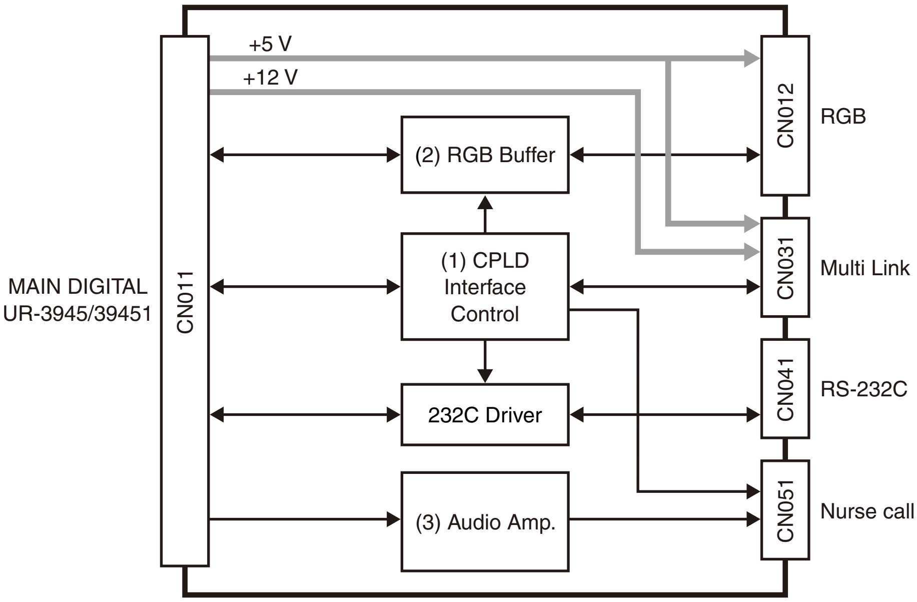
(3) Sound Circuit
Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.

(4) Output Voltage
Multi link communication +12 V ± 5% (load current 500 mA)
Multi link communication +5 V ± 5% (load current 200 mA)
USB +5 V ± 5% (load current 500 mA)

QI-671P Interface

Outline of Function

The interface (QI-671P) is an external interface board connected to the monitor main unit (MU-651R/MU-671R), and is equipped with the RGB output, alarm polling, nurse call, sound output, RS-232C, and multi link.


+5 V
+12 V
MAIN DIGITAL
UR-3945/39451
CN011
(2) RGB Buffer
(1) CPLD Interface Control
232C Driver
(3) Audio Amp.
CN012
RGB
CN031
Multi Link
CN041
RS-232C
CN051
Nurse call

Explanation of Each Circuit Block Operations

(1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-3945/UR-39451) to parallel data. Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

This board also has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

(2) RGB Buffer Circuit

Buffers the analog RGB signals from the monitor main unit MAIN DIGITAL board, and output them externally. Also controls the +5 V power supply by the power supply control signals from the communication controller.

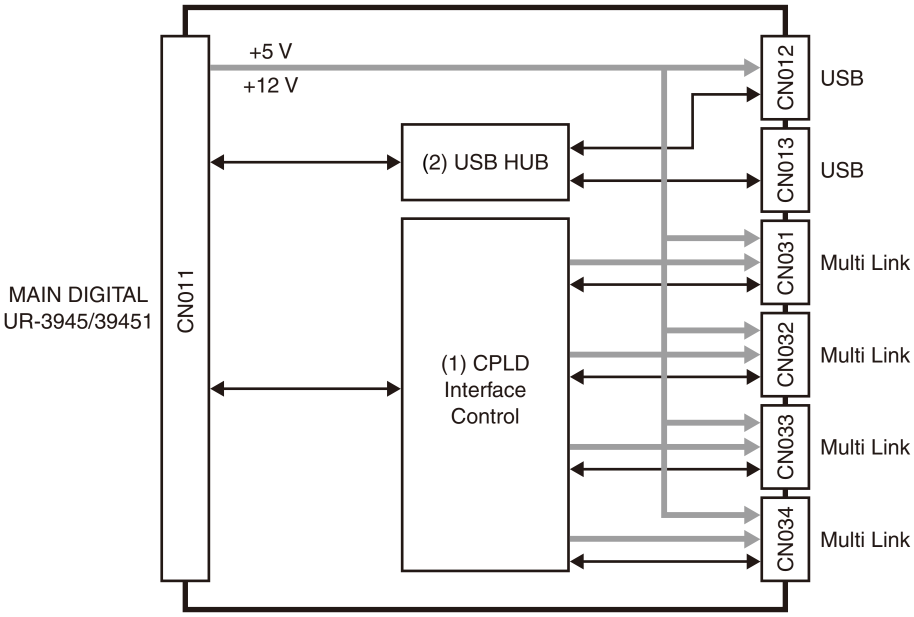
(3) Sound Circuit
Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.

(4) Output Voltage
Multi link communication +12 V ± 5% (load current 500 mA)
Multi link communication +5 V ± 5% (load current 200 mA)
RGB +5 V ± 5% (load current 200 mA)

QI-672P Interface

Outline of Function

The interface (QI-672P) is an external interface board connected to the monitor main unit (MU-651R/MU-671R), and is equipped with USB and multi link.


+5 V
+12 V
MAIN DIGITAL
UR-3945/39451
CN011
(2) USB HUB
(1) CPLD
Interface
Control
CN012
USB
CN013
USB
CN031
Multi Link
CN032
Multi Link
CN033
Multi Link
CN034
Multi Link

Explanation of Each Circuit Block Operation

(1) Communication Control (CPLD)
Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-3945/UR-39451) to parallel data. Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

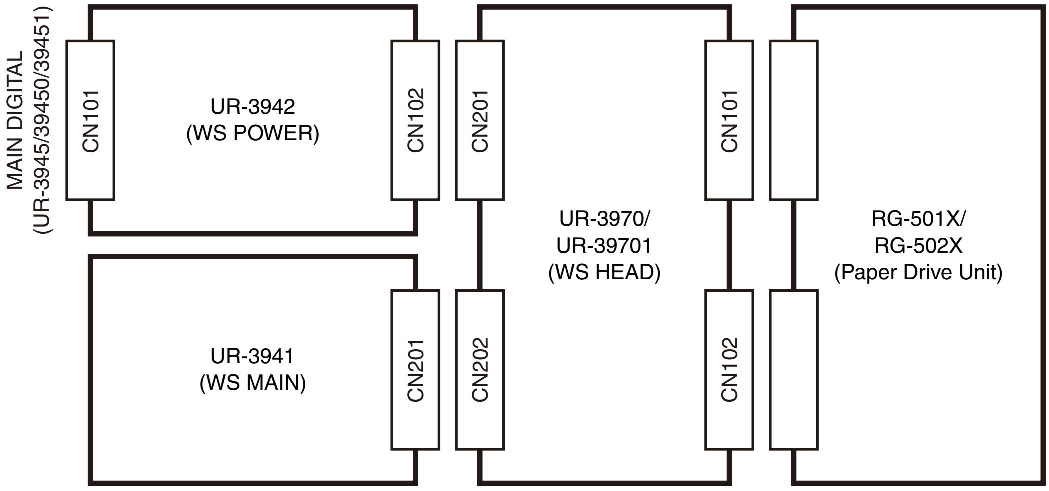
This board also has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

(2) USB Hub Controller
Divides the USB signals from the monitor main unit MAIN DIGITAL board for two ports, by the hub controller.

(3) Output Voltage
Multi link communication +12 V ± 5% (load current 500 mA)
Multi link communication +5 V ± 5% (load current 200 mA)
USB +5 V ± 5% (load current 500 mA)

WS-671P Recorder Module

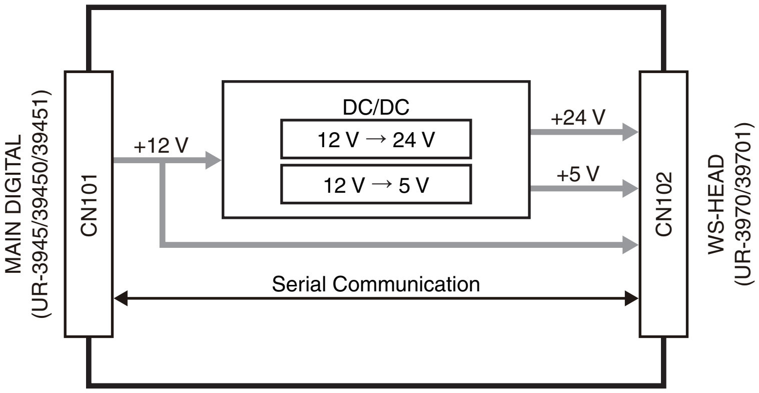
WS-671P Overall Block Diagram


MAIN DIGITAL
(UR-3945/39450/39451)
CN101
UR-3942
(WS POWER)
CN102
CN201
UR-3941
(WS MAIN)
CN201
CN202
UR-3970/
UR-39701
(WS HEAD)
CN101
CN102
RG-501X/
RG-502X
(Paper Drive Unit)

Outline

Controls the recording processes.

UR-3942 WS Power Board


MAIN DIGITAL
(UR-3945/39450/39451)
CN101
+12 V
DC/DC
12 V → 24 V
12 V → 5 V
+24 V
+5 V
Serial Communication
CN102
WS-HEAD
(UR-3970/39701)

Function

1. DC/DC

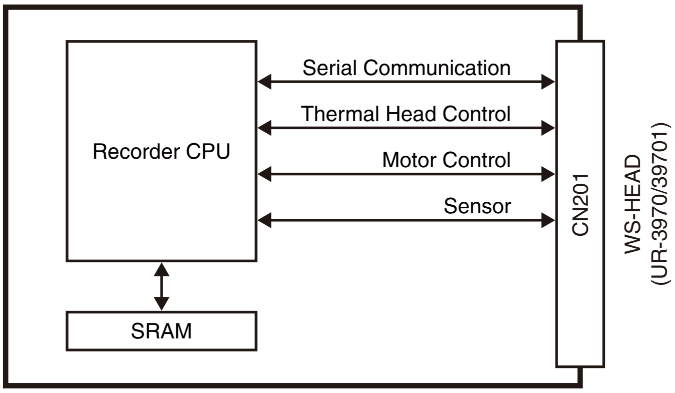
   +24 V: Used as the power to the thermal head.

   +5 V: Used in the overall recorder module.

2. Serial Communication

   Passes signals transmitted between the MAIN DIGITAL board and the WS MAIN board.

UR-3941 WS Main Board


Recorder CPU
Serial Communication
Thermal Head Control
Motor Control
Sensor
SRAM
CN201
WS-HEAD
(UR-3970/39701)

Function

1. Recorder CPU

   The program for the recorder is stored in CPU-internal ROM, and upgrade can be performed on the device itself.

   This CPU performs communication with the device (serial communication), as well as control the thermal head control, motor control, and sensor detection (paper empty, magazine open, mark detection).

2. Serial Communication

   Performs serial communication with Host CPU in the MAIN DIGITAL board (UR-3945/UR-39450/UR-39451).

3. Thermal Head Control

   Detects the head’s temperature from a thermistor in the thermal head, and controls the print density.

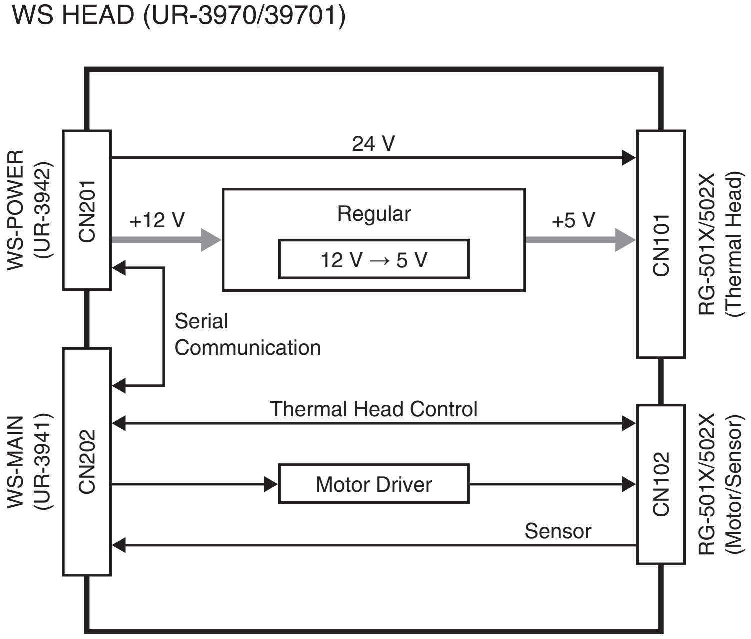
4. Motor Control

   Transmits signals to set the recording speed to 25 mm/s ± 5% or 50 mm/s ± 5% to the motor driver.

5. Sensor

   Detects signals of Paper Empty, Magazine Open and Mark Detection from the sensors in the paper drive unit, and conveys them to the monitor.

UR-3970/39701 WS Head Board


WS HEAD (UR-3970/39701)
WS-POWER (UR-3942)
CN201
24 V
+12 V
Regular
12 V → 5 V
+5 V
CN101
RG-501X/502X (Thermal Head)
Serial Communication
WS-MAIN (UR-3941)
CN202
Thermal Head Control
Motor Driver
Sensor
CN102
RG-501X/502X (Motor/Sensor)

Function

1. Regulator
   5 V: Used for controlling the thermal head.

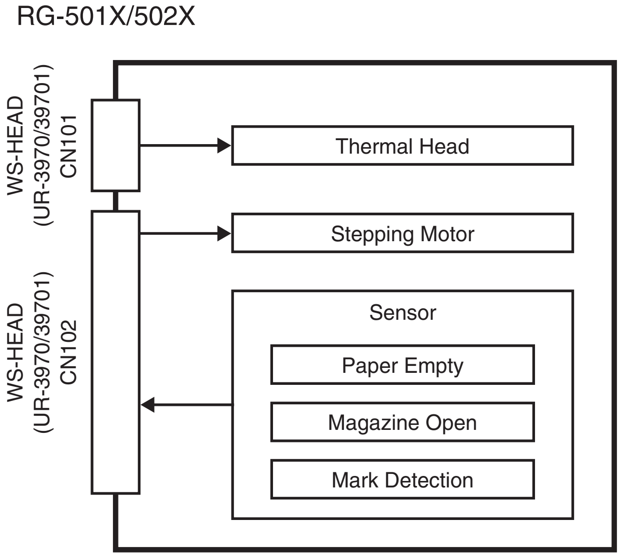
2. Motor Driver
   Converts motor control signals transmitted from the WS MAIN board into RG-501X stepping motor signals.

3. Serial Communication
   Passes signals transmitted between the MAIN DIGITAL board and the WS MAIN board.

4. Thermal Head Control
   Passes thermal head control signals.

5. Sensor
   Passes signals of Paper Empty, Magazine Open and Mark Detection.

RG-501X/502X Paper Drive Unit


RG-501X/502X
WS-HEAD
(UR-3970/39701)
CN101
WS-HEAD
(UR-3970/39701)
CN102
Thermal Head
Stepping Motor
Sensor
Paper Empty
Magazine Open
Mark Detection

Function

1. Thermal Head

   Records on the thermal paper and measure the temperature of the thermal head by thermistor.

   Maximum recording width: more than 46 mm

2. Stepping Motor

   Feeds the recording paper.

3. Sensor

   Detects the out of paper by the photo sensor.

4. Magazine Open

   Detect the opening of the magazine by the lever switch.

5. Mark Detection

   Detects the recording paper mark by the photo sensor.

Section 5 Disassembly and Assembly

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- Removing the Rear Enclosure 5.3
  - Removing the Optional Interface (QI-631P/632P/634P) 5.3
  - Removing the Recorder Module (WS-671P) 5.4
  - Removing the Handle 5.6
  - Removing the Rear Enclosure 5.7
- Removing the SC-631R Power Unit from the Heat Sink Block 5.8
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  - Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-39450) 5.16
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Disassembling the Main Unit (MU-651R/671R) 5.26
- Removing the Rear Enclosure 5.26
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  - Removing the Handle 5.28
  - Removing the Rear Enclosure 5.28
- Removing the SC-671R Power Unit from the Heat Sink Block 5.30
- Removing the 916867 Power Unit 5.33
- Replacing the MAIN DIGITAL Board (UR-3945/39451) 5.35
  - Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-3945/39451) 5.39
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  - MU-671R 5.43
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- Removing the LCD Unit 5.45
  - MU-651R 5.45
  - MU-671R 5.47
- Replacing the Touch Screen 5.49
- Removing the ALARM Board (UR-3955) 5.51
- Removing the Operation Board, Record Key Board and Power SW Board (UR-3954/3984 /3953) 5.52

Disassembling the Input Unit (AY-631P/633P/651P/653P/660P/661P/663P/671P/673P) 5.53
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    Removing the NIBP Unit (SG-670P/671P/673P) 5.58
    Removing the SpO$_2$ Board 5.61
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    Replacing the Thermal Head 5.79

CAUTION

- Before performing replacement, be sure to turn off the power switch.
- Disconnect the power cord and the connection cables.
- When replacing the boards, be sure to confirm the dip switch settings.

Disassembling the Main Unit (MU-631R)

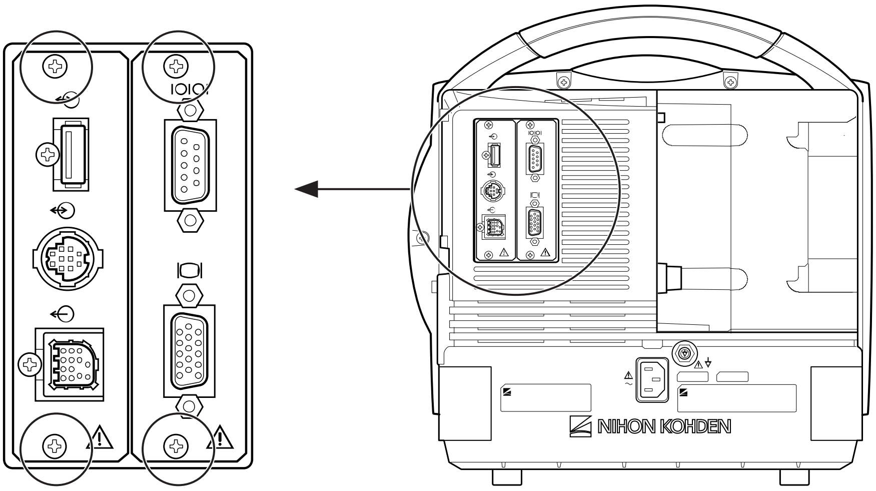
Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, hexagon wrenches (5) and tweezers

Removing the Rear Enclosure

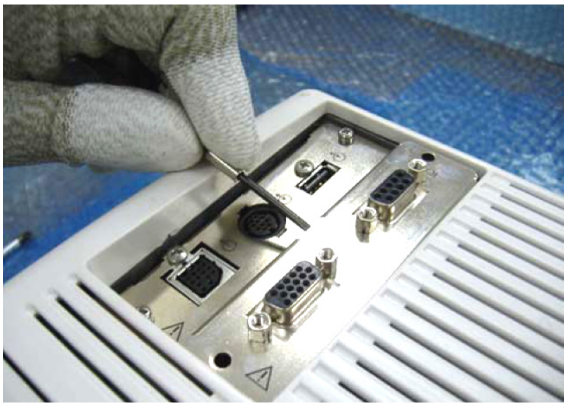
Removing the Optional Interface (QI-631P/632P/634P)

Remove the optional QI-631P and QI-632P or QI-634P interfaces if installed. Example shows the QI-631P and QI-632P interfaces are installed.

1. Remove the four BH3 × 6 screws.



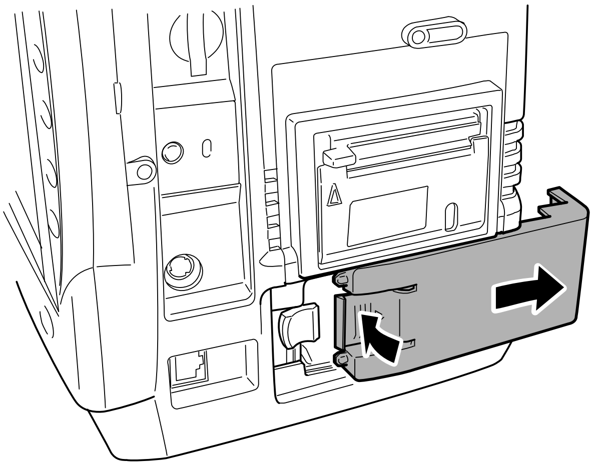
2. Insert the flathead screwdriver between the two interfaces as shown below and pull them out.



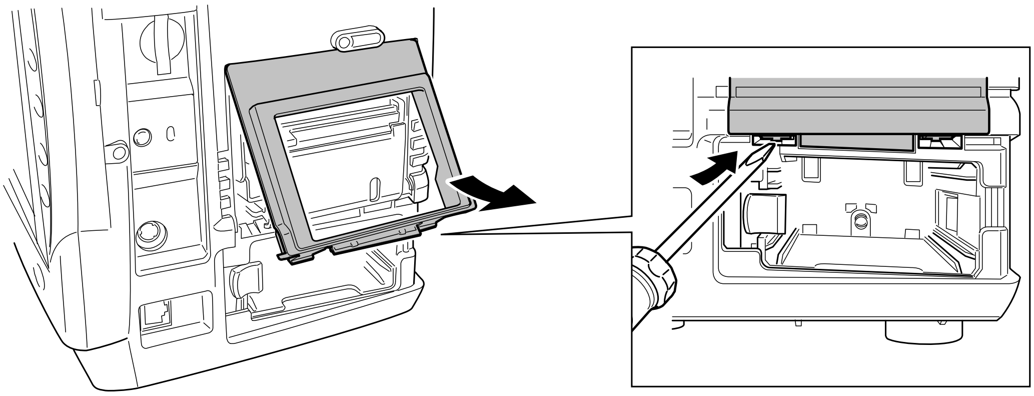
Removing the Recorder Module (WS-671P)

Remove the WS-671P recorder module if installed.

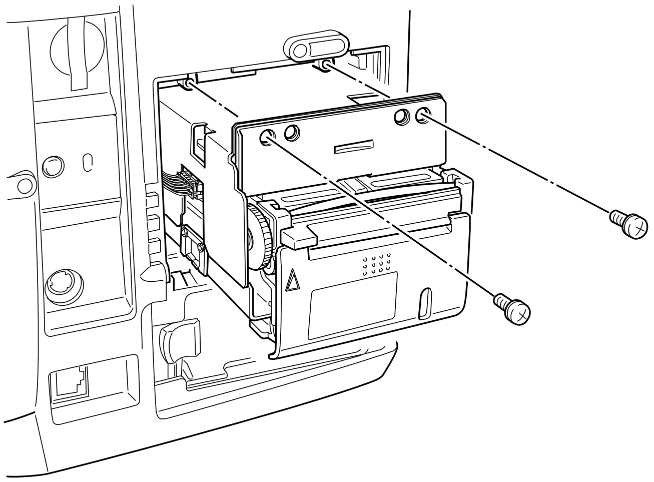
1. Remove the cover from the battery slot 2.



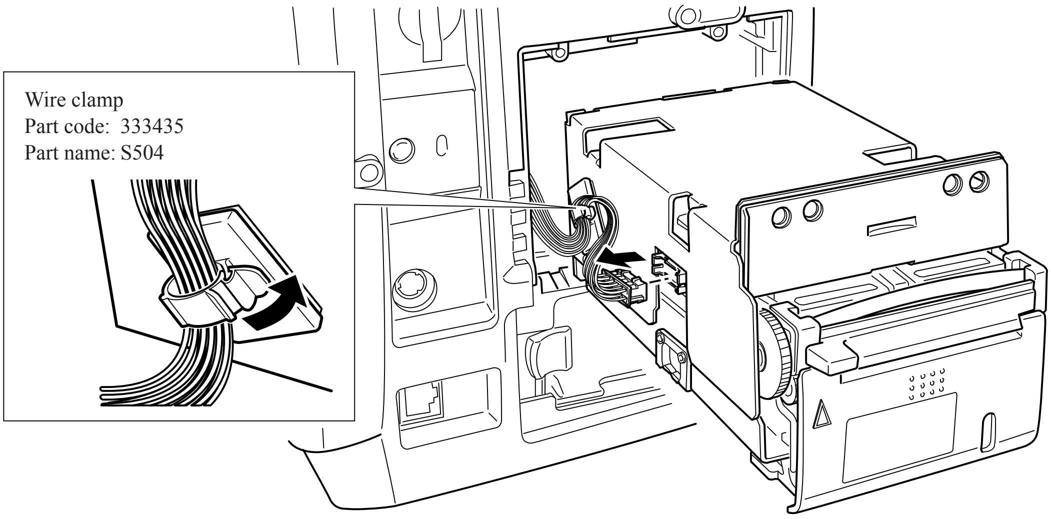
2. Insert the flathead screwdriver as shown below and remove the front cover of the recorder module.



3. Remove the two PS3 × 6 screws fixing the recorder module to the body of bedside monitor.



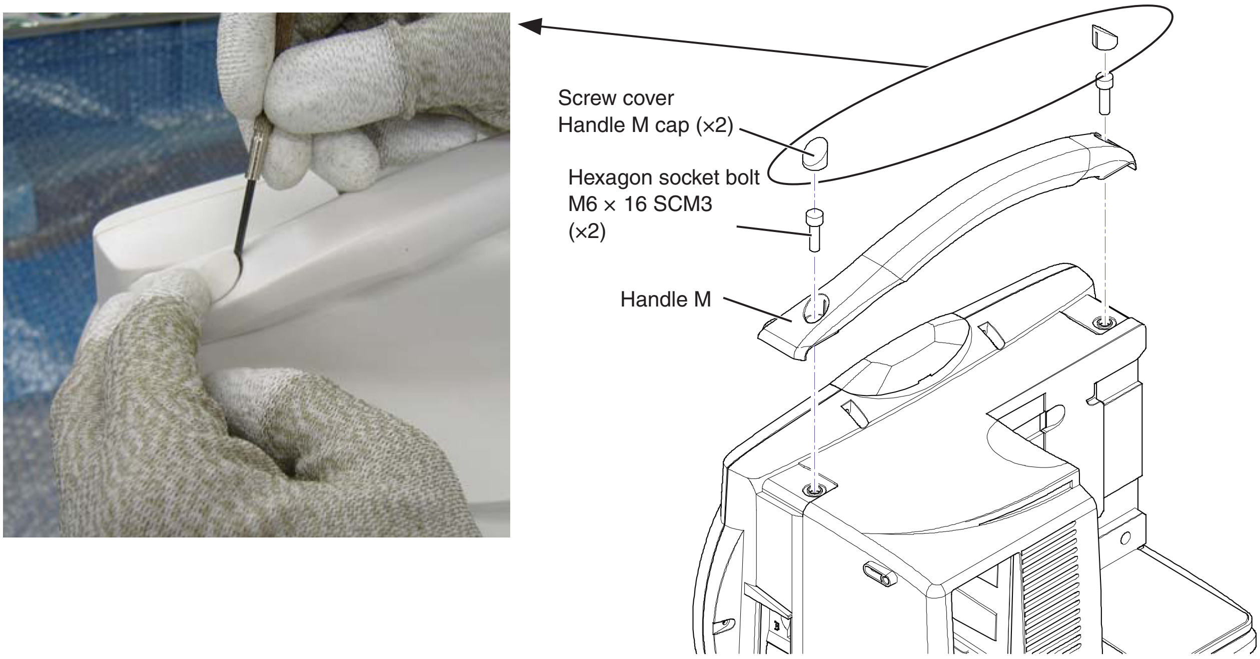
4. Pull out the recorder module. Remove the internal cable from the wire clamp and from the connector connected to the recorder module.


Wire clamp
Part code: 333435
Part name: S504

Removing the Handle

1. Use the flathead screwdriver to remove the two screw covers (handle M caps) from the right and left ends of the handle.

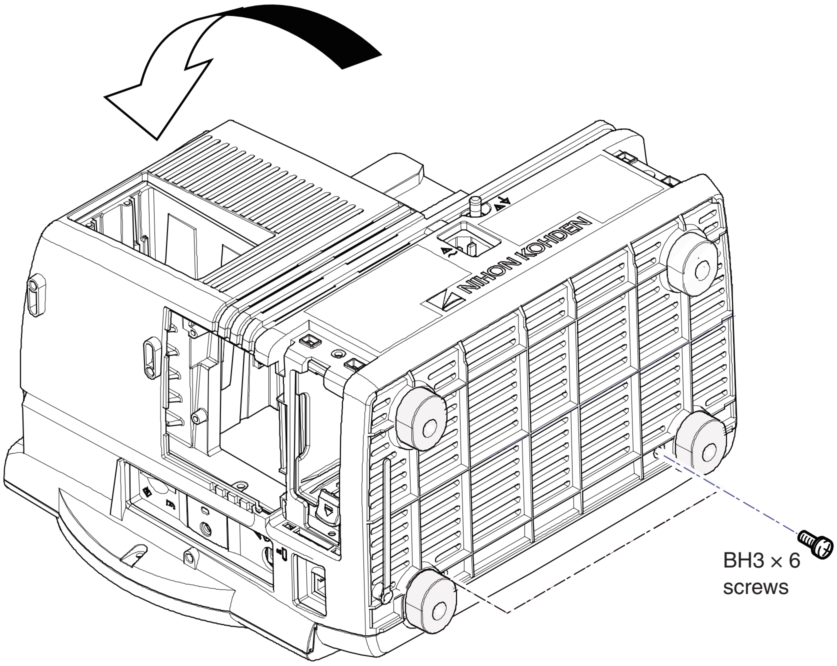
2. Use the hexagon wrench to remove the two hexagon socket bolts (M6 × 16 SCM3). Then remove the handle M.


Screw cover
Handle M cap (×2)
Hexagon socket bolt
M6 × 16 SCM3
(×2)
Handle M

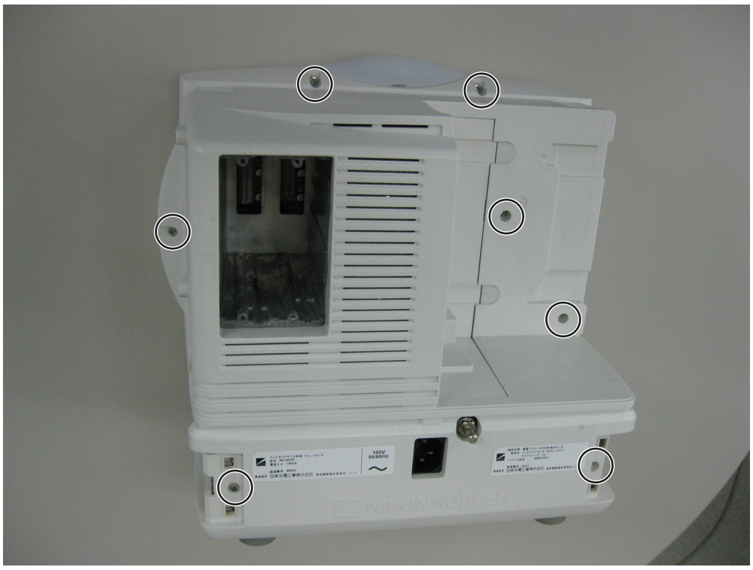
Removing the Rear Enclosure

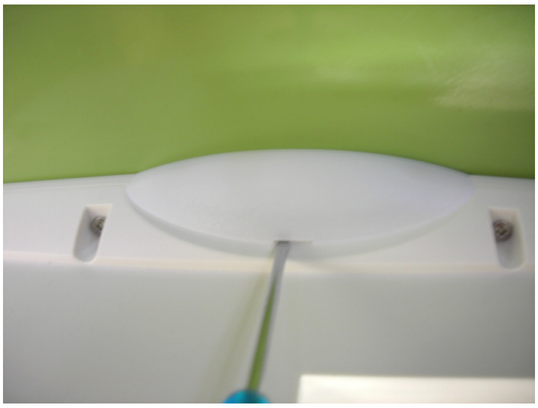
1. Remove the cover from the battery slot 1 on the left side.

2. Lay the monitor face down and remove the two BH3 × 6 screws from the bottom of the bedside monitor.



3. Remove the seven BH3 × 6 screws from the rear enclosure. Insert the flathead screwdriver between the alarm indicator and the rear enclosure and remove the rear enclosure.

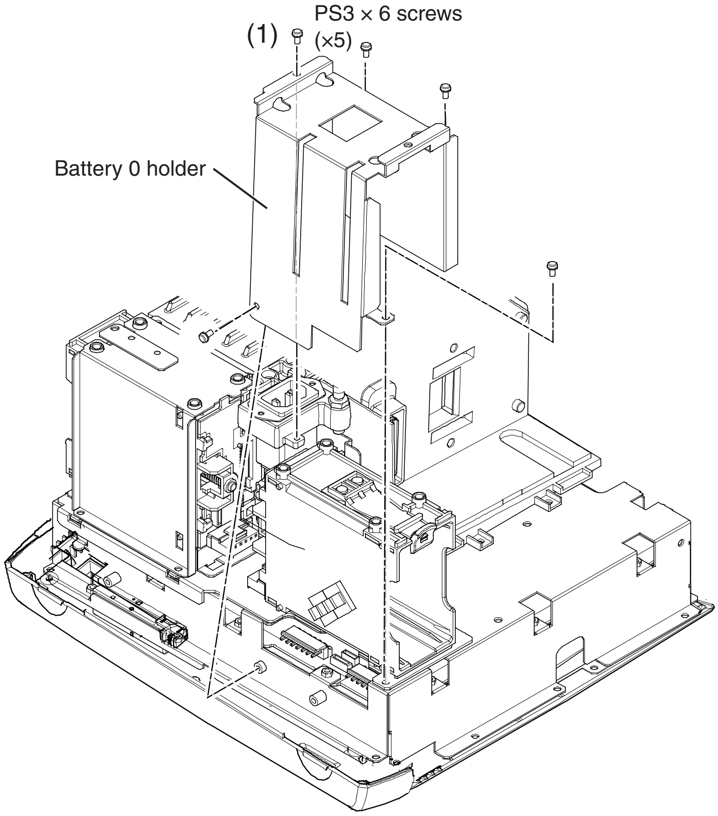




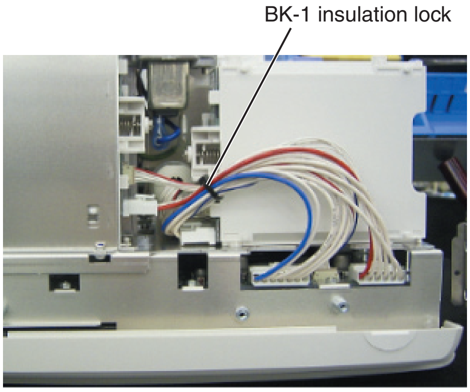
Removing the SC-631R Power Unit from the Heat Sink Block

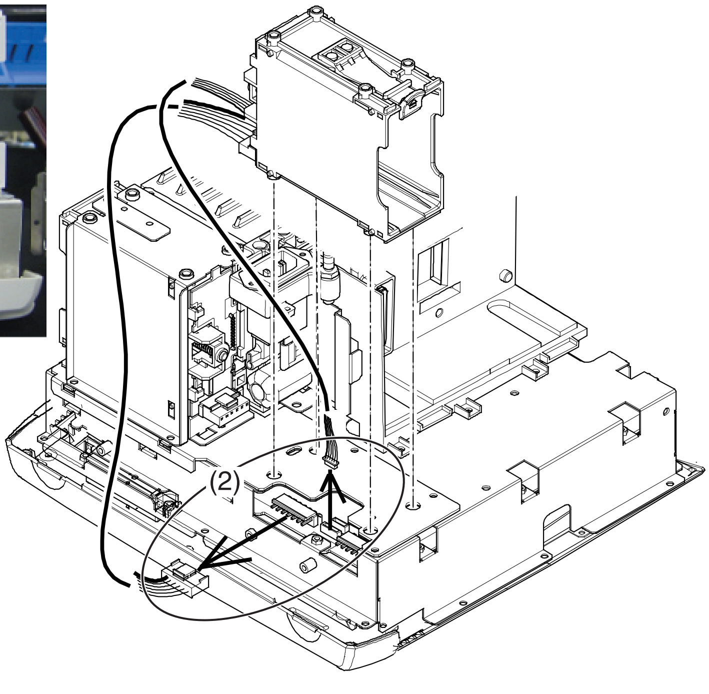
1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

2. Remove the five PS3 × 6 screws of (1) and battery 0 holder.

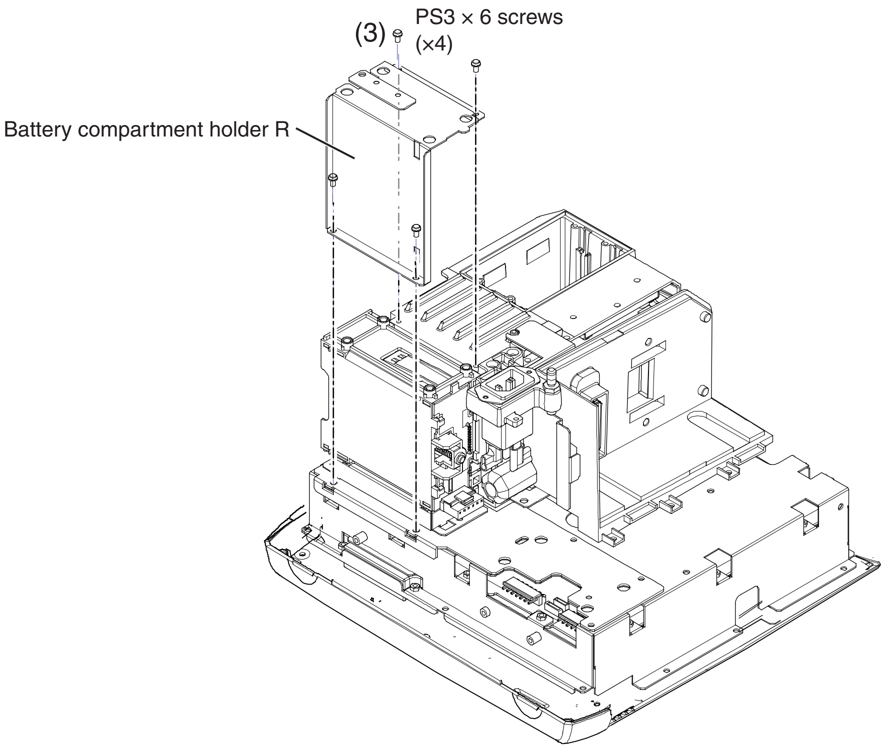

(1)
PS3 × 6 screws
(×5)
Battery 0 holder

3. Take out the BK-1 insulation lock that bundles cables and remove the two cables of (2). Then remove the battery compartment from the left side of the rear enclosure.

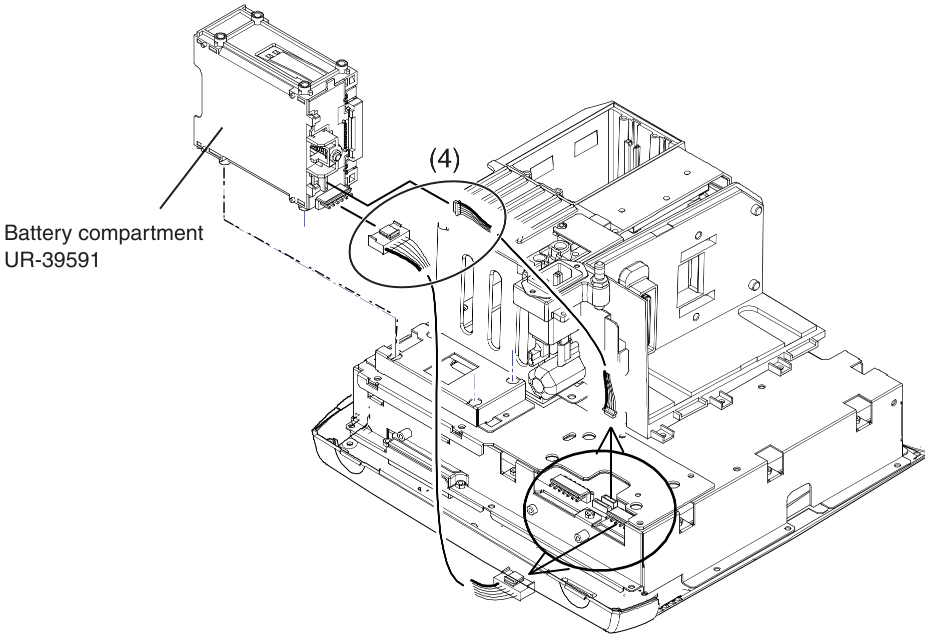

BK-1 insulation lock



4. Remove the four PS3 × 6 screws of (3) and battery compartment holder R.

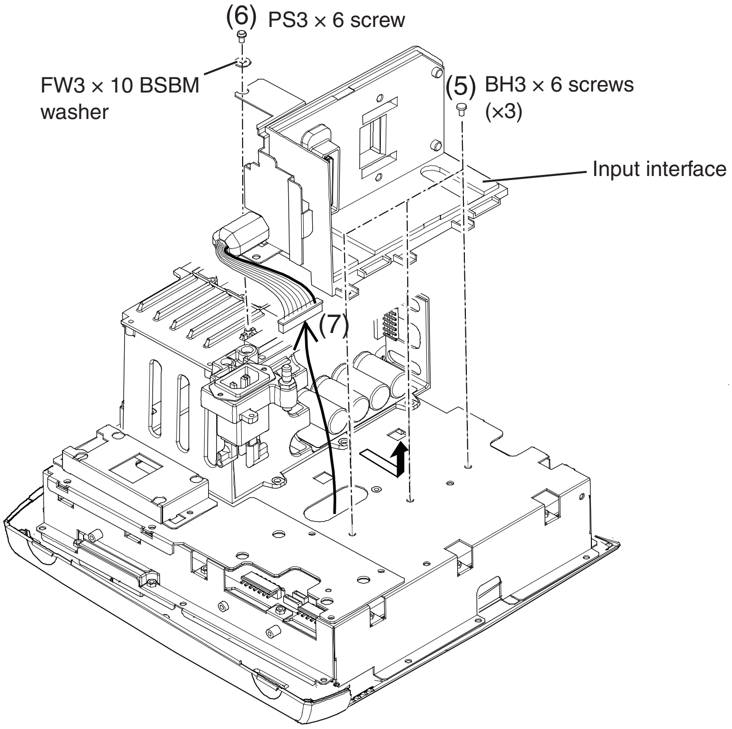

(3)
PS3 × 6 screws
(×4)
Battery compartment holder R

5. Remove the two cables of (4) and remove the battery compartment.


(4)
Battery compartment
UR-39591

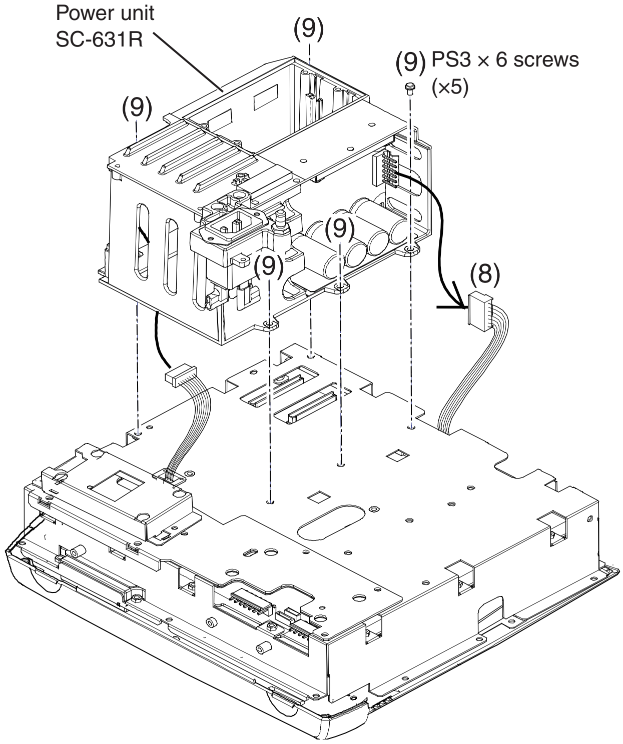
6. Remove the three BH3 × 6 screws of (5) and remove the PS3 × 6 screw and the FW3 × 10 BSBM washer of (6). Slide the input interface to the direction indicated with the arrow and lift it upward.

7. Disconnect the cable connector of (7) from the MAIN DIGITAL board and remove the input interface.


(6) PS3 × 6 screw
FW3 × 10 BSBM washer
(5) BH3 × 6 screws (×3)
Input interface
(7)

8. Remove the cable of (8) from the power unit.

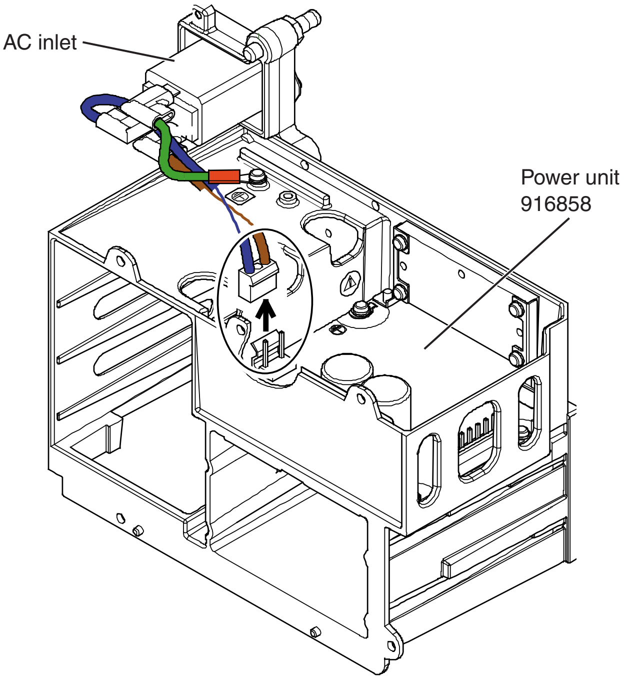
9. Remove the five PS3 × 6 screws of (9) and remove the SC-631R power unit.


Power unit SC-631R
(9)
(9) PS3 × 6 screws (×5)
(9)
(9)
(9)
(8)

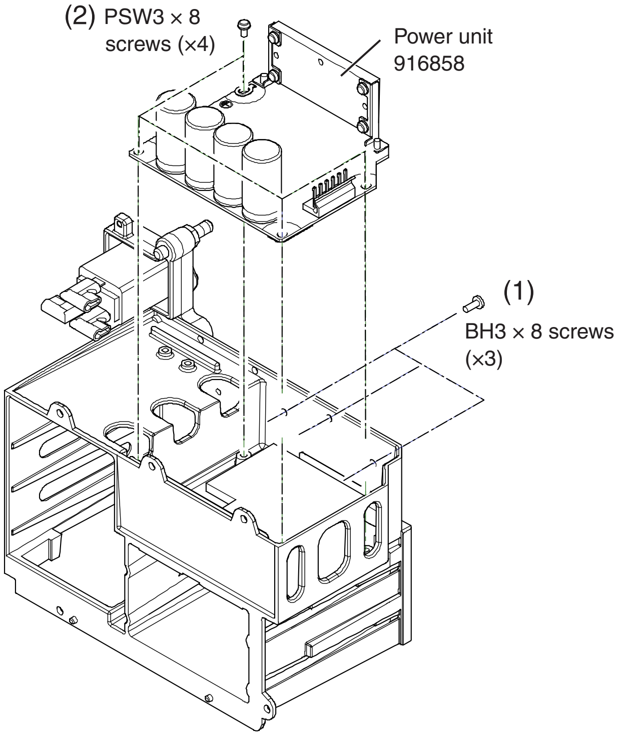
Removing the 916858 Power Unit

1. Remove the power unit. For details, refer to “Removing the SC-631R Power Unit from the Heat Sink Block”.

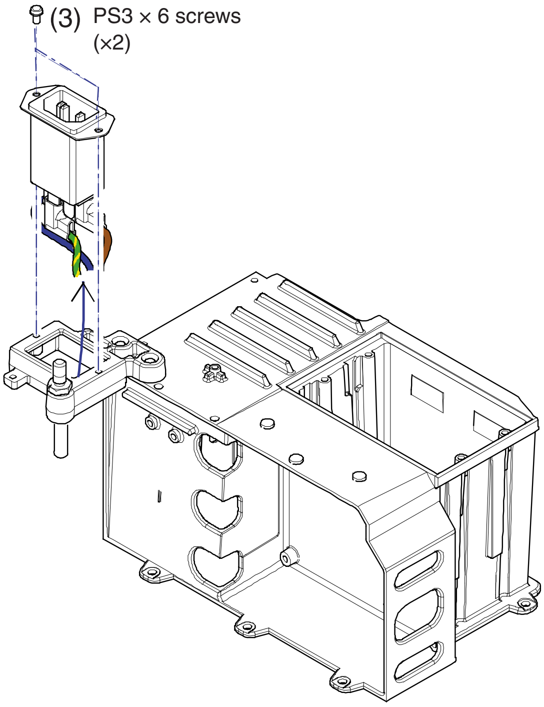
2. Disconnect the cable which connects the AC inlet and the 916858 power unit from the SC-631R power unit.


AC inlet
Power unit
916858

3. Remove the three BH3 × 8 screws of (1) and the four PSW3 × 8 screws of (2). Then remove the 916858 power unit.

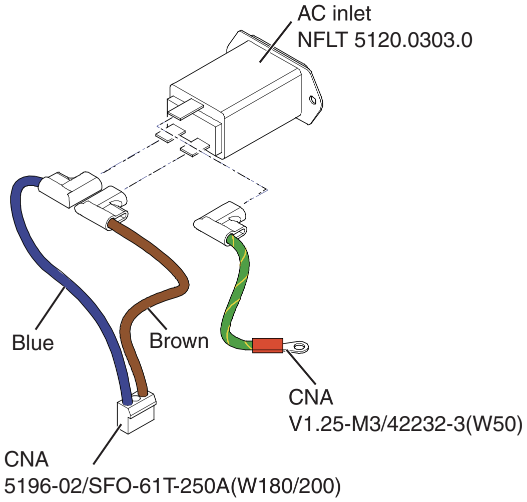

(2) PSW3 × 8
screws (×4)
Power unit
916858
(1)
BH3 × 8 screws
(×3)

4. Remove the two PS3 × 6 screws of (3) and AC inlet.


(3) PS3 × 6 screws
(×2)

NOTE

Pay attention to cable colors when connecting the AC inlet.


AC inlet
NFLT 5120.0303.0
Blue
Brown
CNA
V1.25-M3/42232-3(W50)
CNA
5196-02/SFO-61T-250A(W180/200)

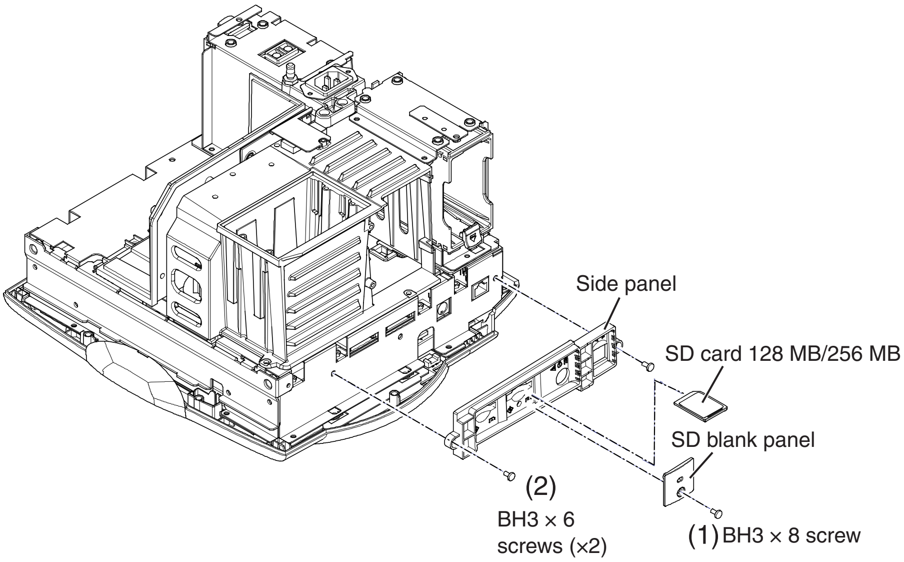
Replacing the MAIN DIGITAL Board (UR-39450)

NOTE

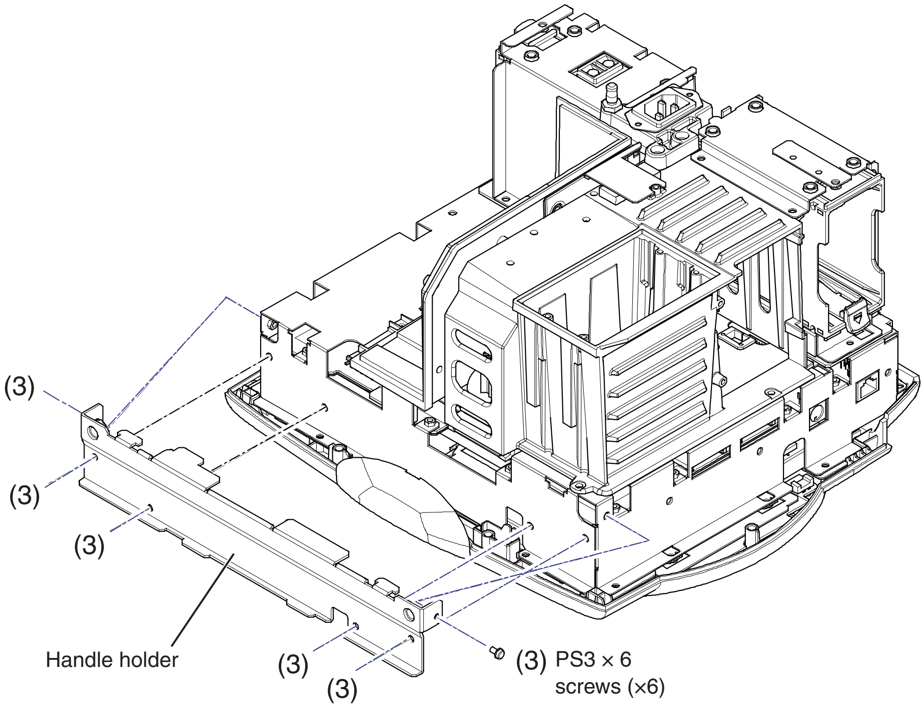
After replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to the "Calibrating the Touch Panel" in Section 3.

1. Remove the rear enclosure. For details, refer to "Removing the Rear Enclosure".

2. Remove the BH3 × 8 screw of (1) and the two BH3 × 6 screws of (2). Then remove the SD blank panel and side panel and pull out the SD card.

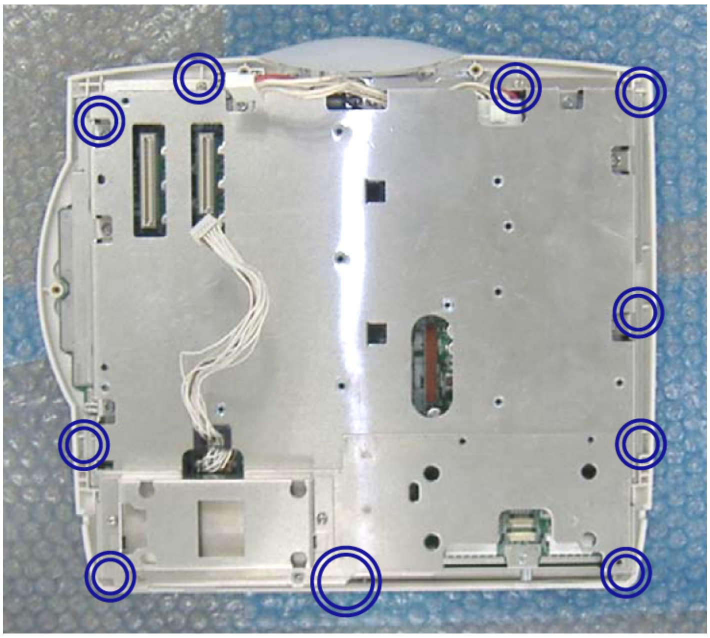

Side panel
SD card 128 MB/256 MB
SD blank panel
(2)
BH3 × 6
screws (×2)
(1) BH3 × 8 screw

3. Remove the six PS3 × 6 screws of (3), one from each side and four from the top. Then remove the handle holder.

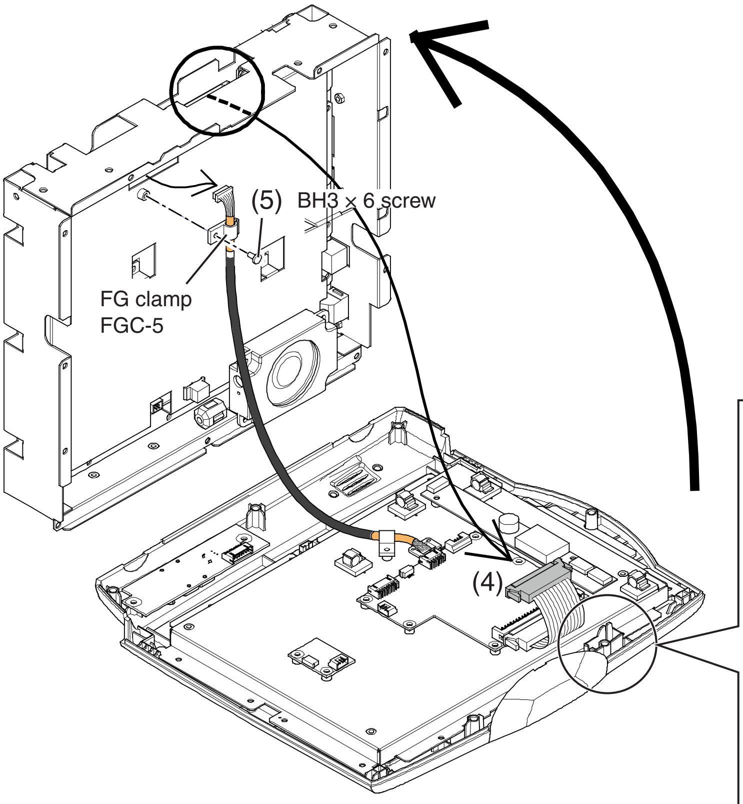

(3)
(3)
(3)
Handle holder
(3)
(3)
(3) PS3 × 6
screws (×6)

4 Remove the SC-631R power unit. For details, refer to “Removing the SC-631R Power Unit.”

5. Remove the ten PS3 × 6 screws.

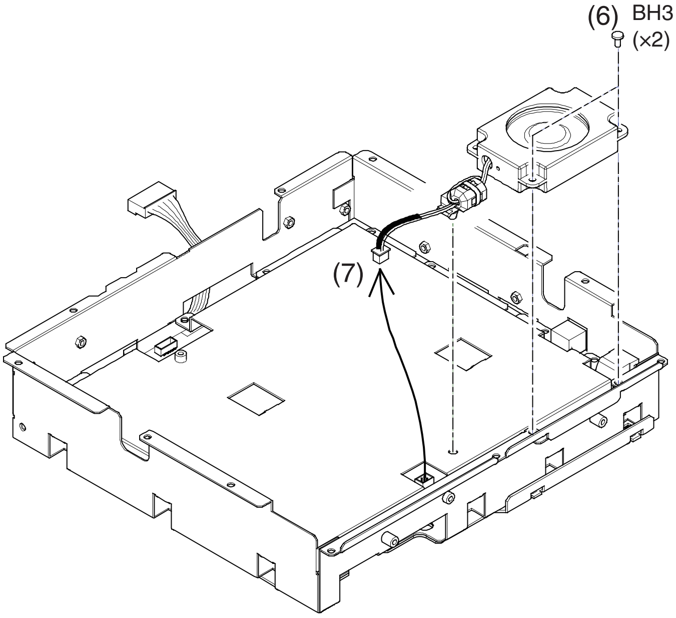


6. Disconnect the flat cable of (4) and remove the BH3 × 6 screw of (5) that fixes the FG clamp (FGC-5). Then remove the cable connector between the MAIN DIGITAL board and the FRONT IF board from the MAIN DIGITAL board.

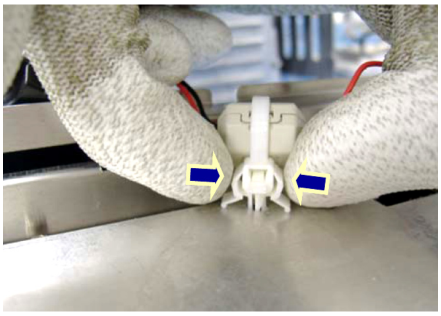


When reassembling the unit, take care not to trap the alarm indicator cable.

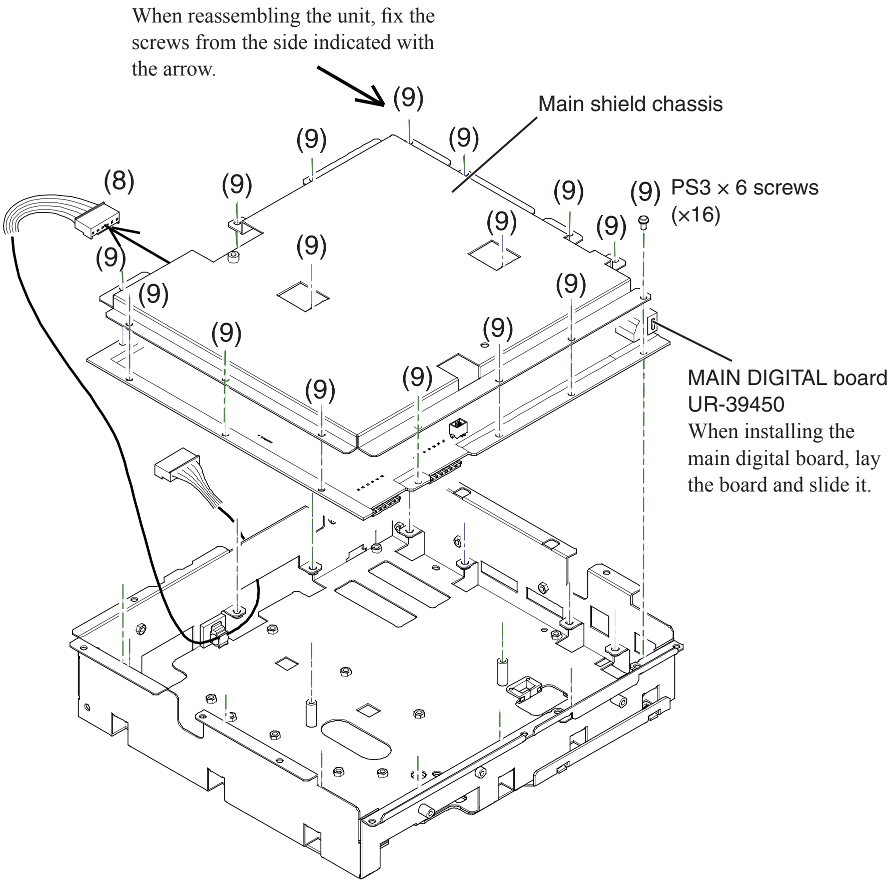
7. Remove the two BH3 × 6 screws of (6) and remove the fixture of ferrite core from the chassis. Then remove the connector of (7) and the speaker.


(6) BH3 × 6 screws
(×2)
(7)

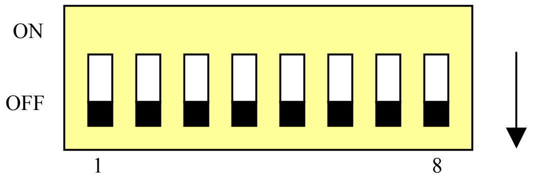
Pinch the ferrite core fixture as shown below and remove it.



8. Remove the connector of (8) and the sixteen PS3 × 6 screws of (9). Lift and remove the main shield chassis and remove the MAIN DIGITAL board.


When reassembling the unit, fix the screws from the side indicated with the arrow.
(9)
Main shield chassis
(8)
(9) PS3 × 6 screws
(×16)
MAIN DIGITAL board
UR-39450
When installing the main digital board, lay the board and slide it.

Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-39450)



Bits 1 to 8 of the S17100 dip switch on the board must be set to OFF.

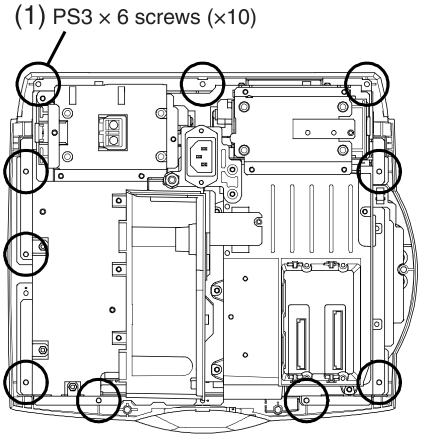
Removing the FRONT IF Board (UR-3956)

1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

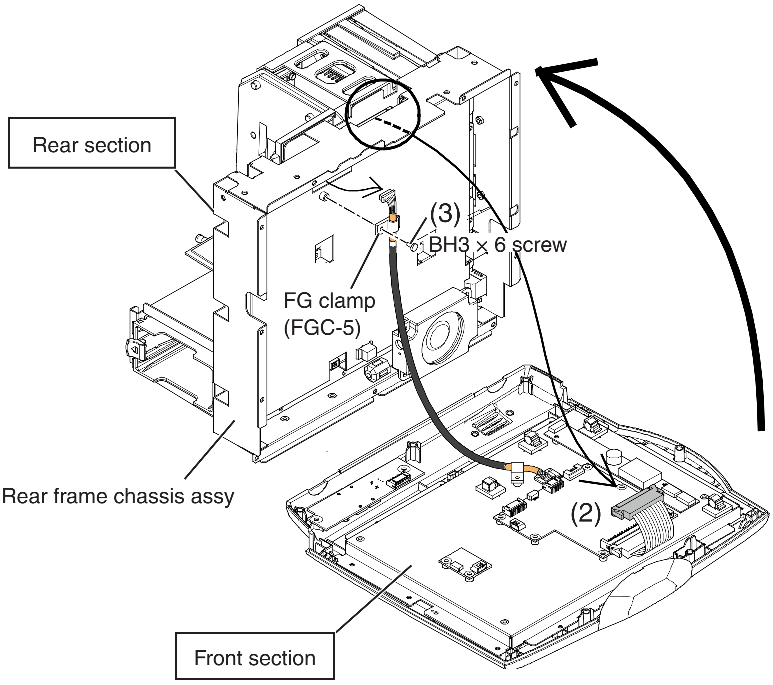
2. Remove the BH3 × 8 screw and the two BH3 × 6 screws. Then remove the SD blank panel and side panel and pull out the SD card. For details, refer to step 2 of “Replacing the MAIN DIGITAL Board (UR-39450)”.

3. Remove the six PS3 × 6 screws, one from each side and four from the top. Then remove the handle holder. For details, refer to step 3 of “Replacing the MAIN DIGITAL Board (UR-39450)”.

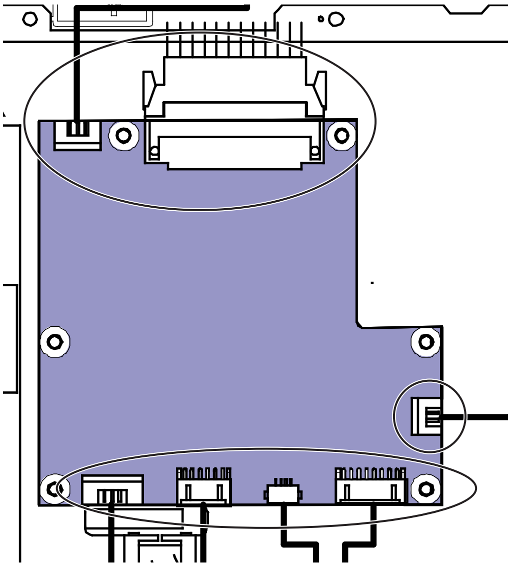
4. Remove the ten PS3 × 6 screws of (1).



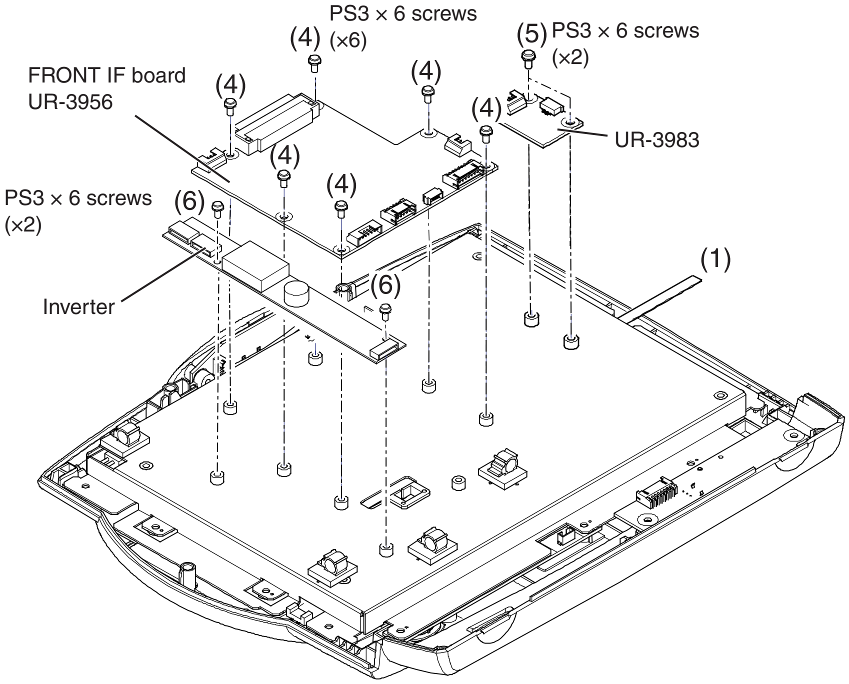
5. Disconnect the cable of (2) from the main digital board. Remove the BH3 × 6 screw of (3) that fixes the FG clamp (FGC-5) and remove the cable connected to the MAIN DIGITAL board. Lift the rear frame chassis assy and separate the front and rear sections.


Rear section
(3)
BH3 × 6 screw
FG clamp
(FGC-5)
Rear frame chassis assy
(2)
Front section

6. Remove all the seven cables connected to the FRONT IF board (UR-3956).



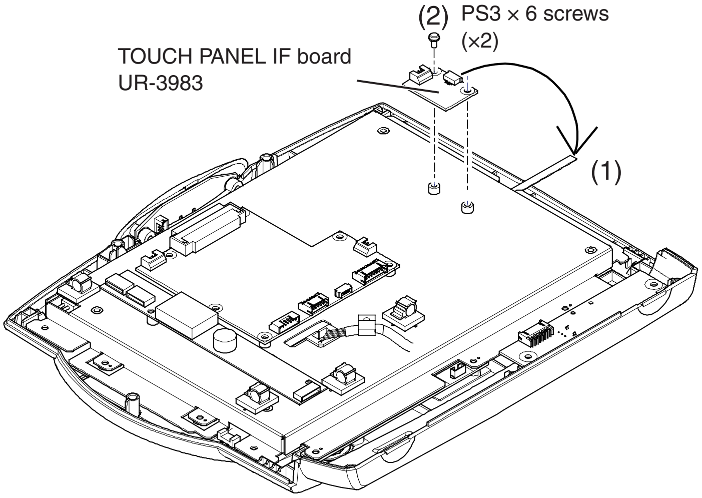
7. Remove the six PS3 × 6 screws of (4) and remove the FRONT IF board (UR-3956) from the main chassis front.


PS3 × 6 screws (×6)
(4)
(5)
PS3 × 6 screws (×2)
FRONT IF board UR-3956
(4)
(4)
(4)
(4)
(4)
UR-3983
PS3 × 6 screws (×2)
(6)
(6)
(1)
Inverter

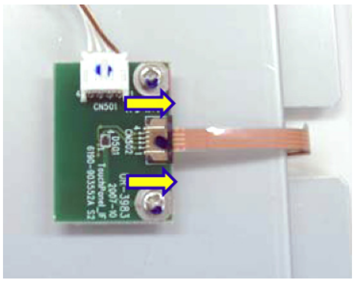
Removing the TOUCH PANEL IF Board (UR-3983)

1. Remove the rear frame chassis assy. For details, refer to steps 1 to 5 of “Removing the FRONT IF Board (UR-3956)”.

2. Remove the touch screen cable of (1) and the two PS3 × 6 screws of (2). Then remove the TOUCH PANEL IF board from the main chassis front.

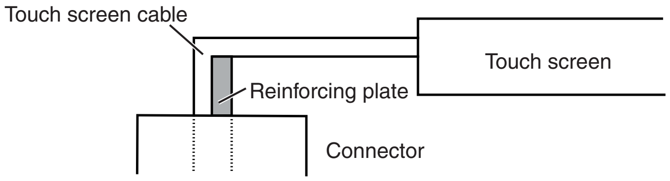

(2) PS3 × 6 screws (×2)
TOUCH PANEL IF board
UR-3983
(1)

When removing the touch screen cable of (1), slide the black part of the connector.



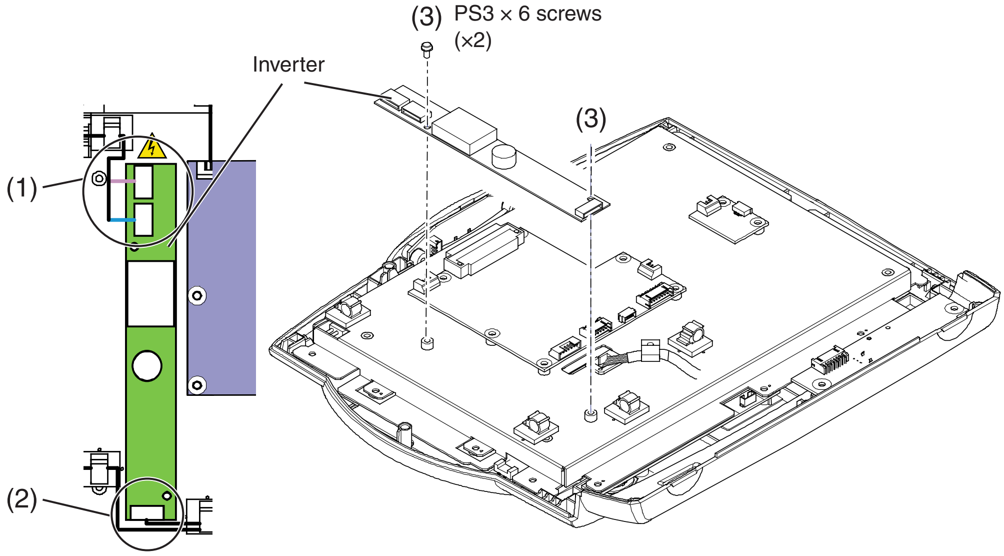
NOTE

Do not fold or bend the touch screen cable. The cable may break.
On the connector insertion part, the reinforcing plate is attached. Take care to avoid excessive force while inserting the connector. Unnecessary removal and insertion of the connector may damage the touch screen.


Touch screen cable
Touch screen
Reinforcing plate
Connector

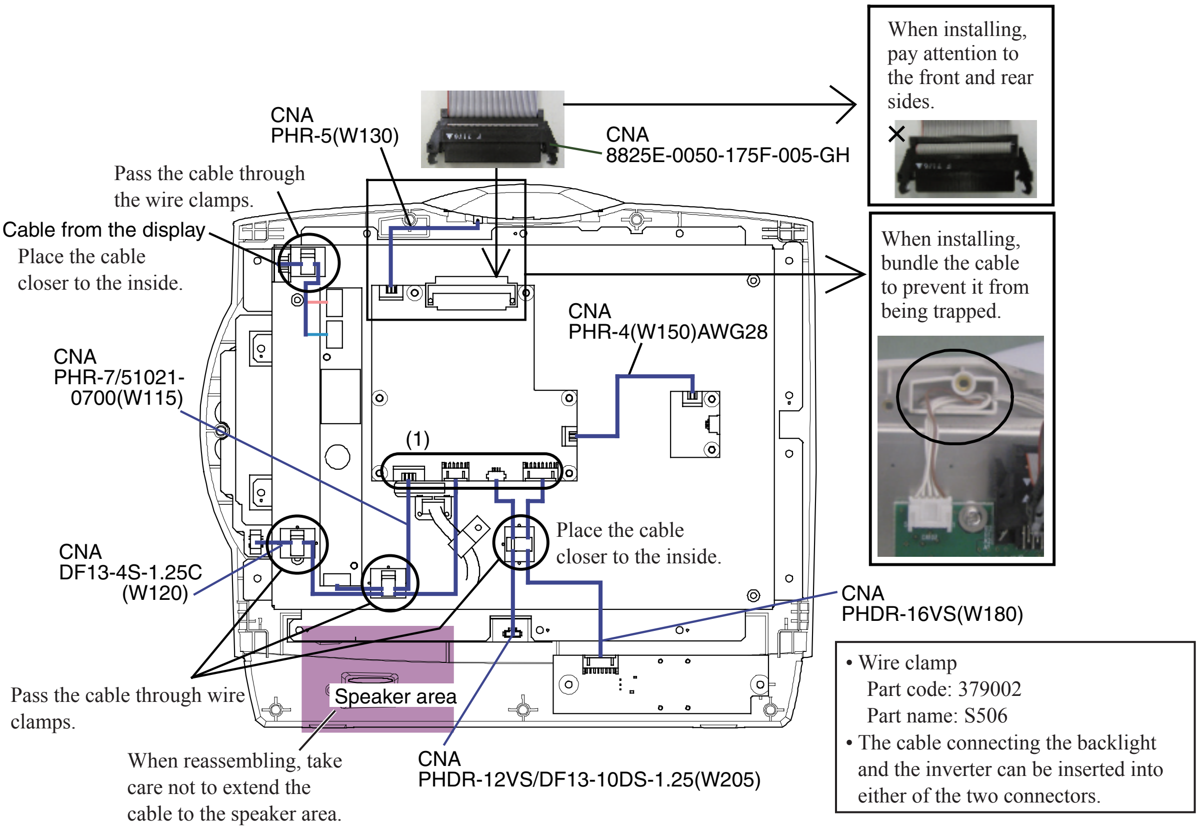
Removing the Inverter

1. Remove the rear frame chassis assy and separate the front and rear sections. For details, refer to steps 1 to 5 of “Removing the FRONT IF Board (UR-3956)”.
2. Disconnect the cable of (1) connected to the LCD, and the cable of (2) connected to the front interface.
3. Remove the two PS3 × 6 screws of (3) and remove the inverter from the main chassis front.


(3) PS3 × 6 screws
(×2)
Inverter
(3)
(1)
(2)

NOTE

Take care of the following when installing the boards and cables.


CNA
PHR-5(W130)
CNA
8825E-0050-175F-005-GH
Pass the cable through
the wire clamps.
Cable from the display
Place the cable
closer to the inside.
CNA
PHR-4(W150)AWG28
CNA
PHR-7/51021-
0700(W115)
(1)
CNA
DF13-4S-1.25C
(W120)
Place the cable
closer to the inside.
CNA
PHDR-16VS(W180)
Pass the cable through wire
clamps.
Speaker area
When reassembling, take
care not to extend the
cable to the speaker area.
CNA
PHDR-12VS/DF13-10DS-1.25(W205)
×

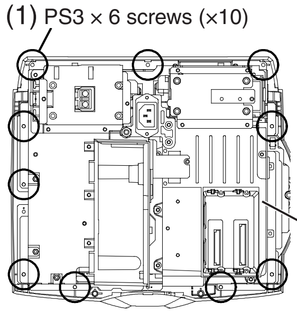
When installing, pay attention to the front and rear sides.

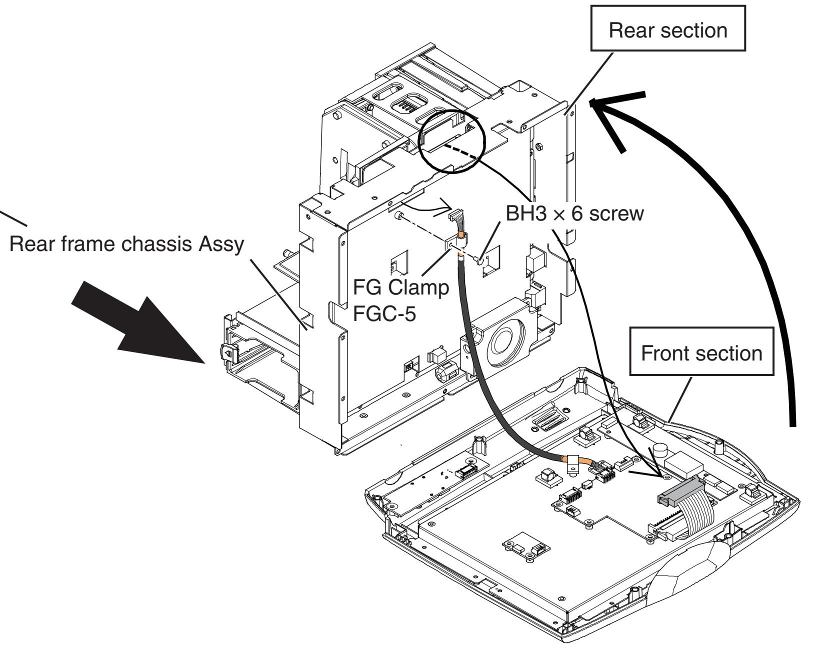
When installing, bundle the cable to prevent it from being trapped.

- Wire clamp
  Part code: 379002
  Part name: S506
- The cable connecting the backlight and the inverter can be inserted into either of the two connectors.

Removing the LCD Unit

1. Remove the rear enclosure and ten PS3 × 6 screws of (1). Then lift the rear frame chassis assy and separate the front and rear sections. For details, refer to steps 1 to 5 of “Removing the FRONT IF Board (UR-3956)”.

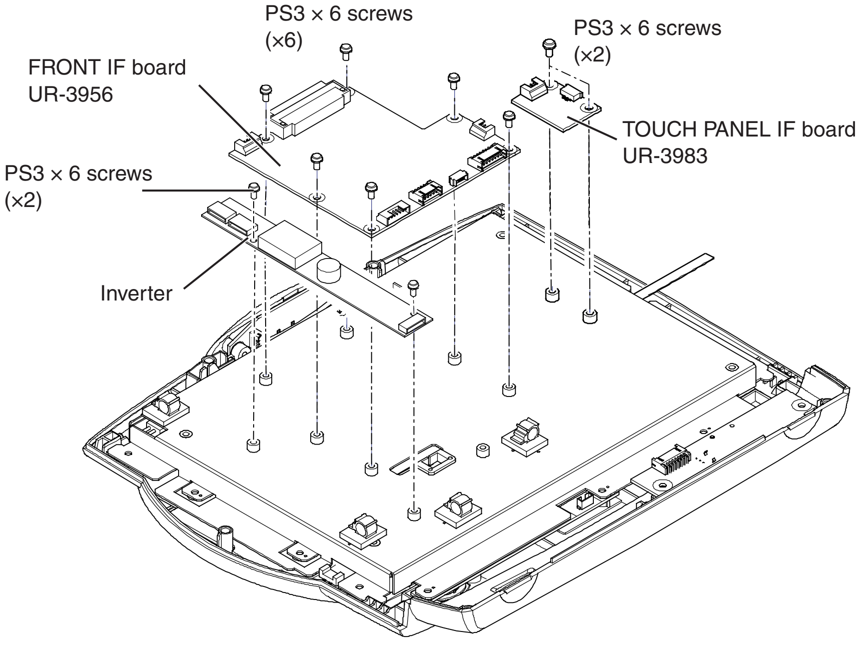

(1) PS3 × 6 screws (×10)


Rear section
Rear frame chassis Assy
BH3 × 6 screw
FG Clamp
FGC-5
Front section

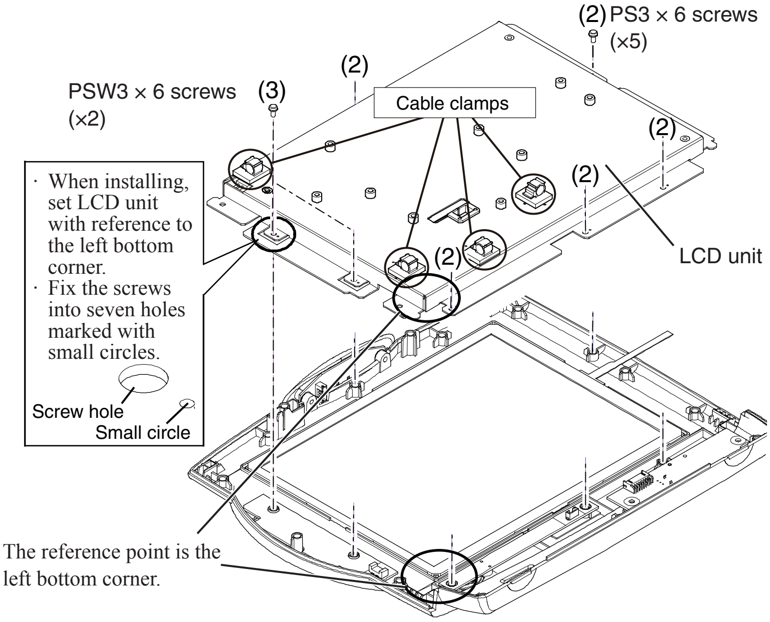
2. Remove the FRONT IF board. For details, refer to steps 6 and 7 of “Removing the FRONT IF Board (UR-3956)”.

3. Remove the touch panel IF. For details, refer to “Removing the TOUCH PANEL IF Board (UR-3983)”.

4. Remove the inverter. For details, refer to “Removing the Inverter”.


PS3 × 6 screws
(×6)
PS3 × 6 screws
(×2)
FRONT IF board
UR-3956
TOUCH PANEL IF board
UR-3983
PS3 × 6 screws
(×2)
Inverter

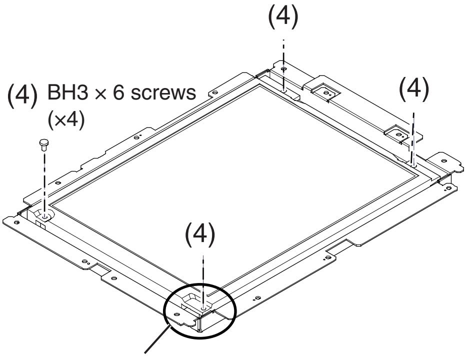
5. Remove the cable from all cable clamps. Remove the five PS3 × 6 screws of (2) and the two PSW3 × 6 screws of (3). Then remove the main chassis front.


(2) PS3 × 6 screws
(×5)
(2)
PSW3 × 6 screws (3)
(×2)
Cable clamps
(2)
(2)
(2)
LCD unit
Screw hole
Small circle

· When installing, set LCD unit with reference to the left bottom corner.
· Fix the screws into seven holes marked with small circles.

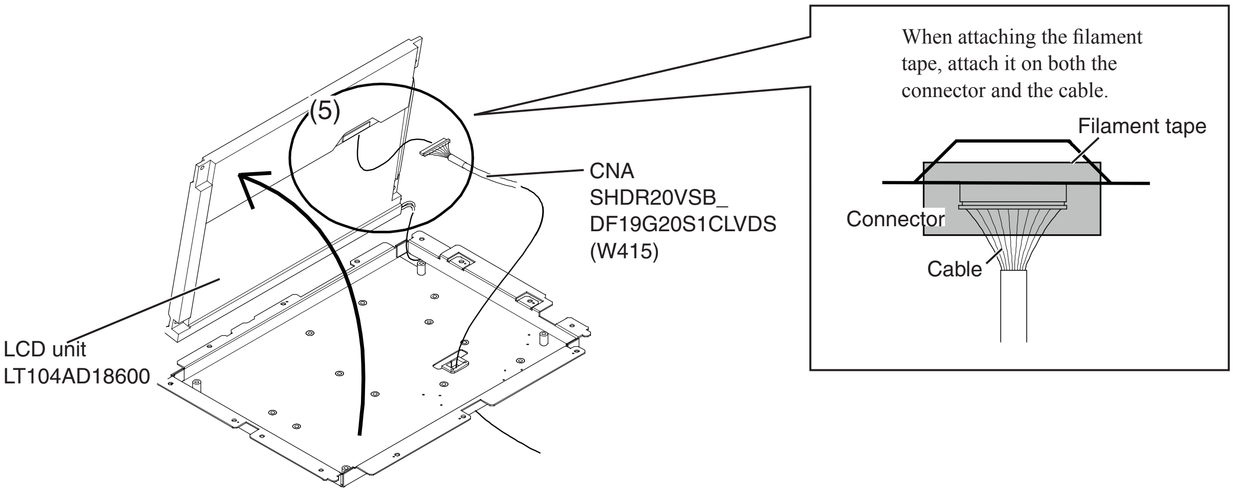
The reference point is the left bottom corner.

6. Turn the main chassis front upside down and remove the four BH3 × 6 screws of (4).


(4)
(4) BH3 × 6 screws
(×4)
(4)
(4)

When installing, install it with reference to the left bottom corner.

7. Remove the filament tape (Sumitomo 3M, No. 897, 18 × 40 mm) or locally available insulating tape which has a fire resistance exceeding that specified in UL 94V-0. Disconnect the CNA cable of (5) and remove the LCD unit.

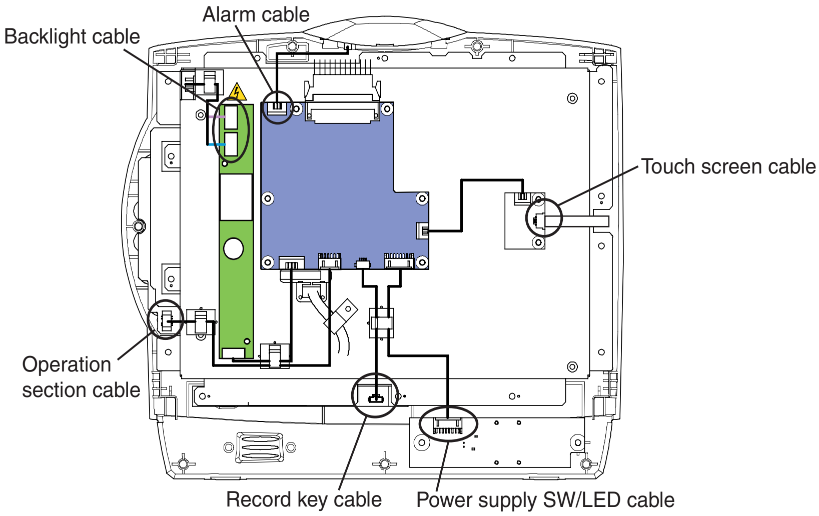

(5)
CNA
SHDR20VSB_
DF19G20S1CLVDS
(W415)
LCD unit
LT104AD18600
Filament tape
Connector
Cable

When attaching the filament tape, attach it on both the connector and the cable.

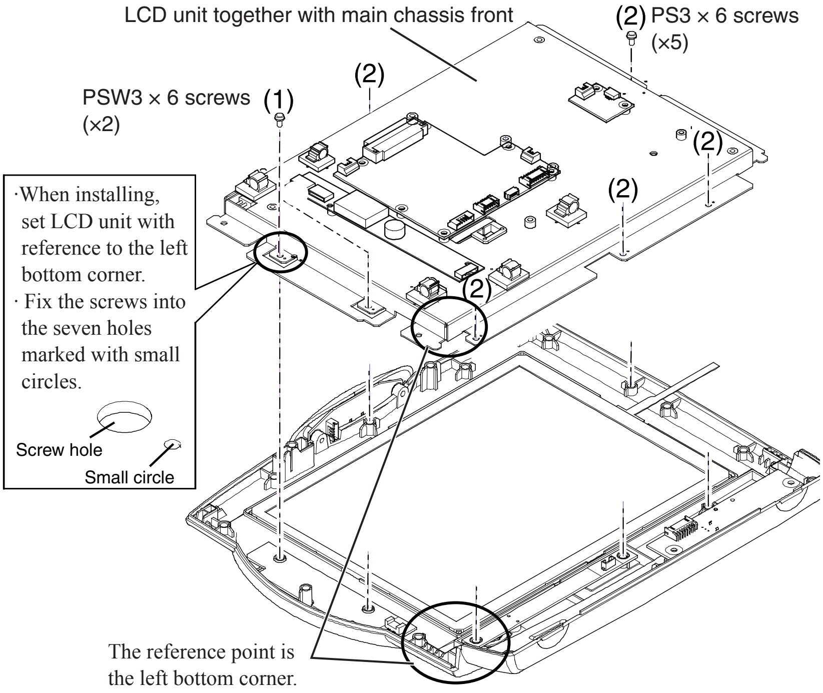
Replacing the Touch Screen

1. Remove the rear enclosure and separate the front and rear sections. For details, refer to step 1 of “Removing the LCD Unit”.

2. Remove the touch screen cable, backlight cable, alarm cable, operation section cable, record key cable and power supply SW/LCD cable.


Alarm cable
Backlight cable
Touch screen cable
Operation section cable
Record key cable
Power supply SW/LED cable

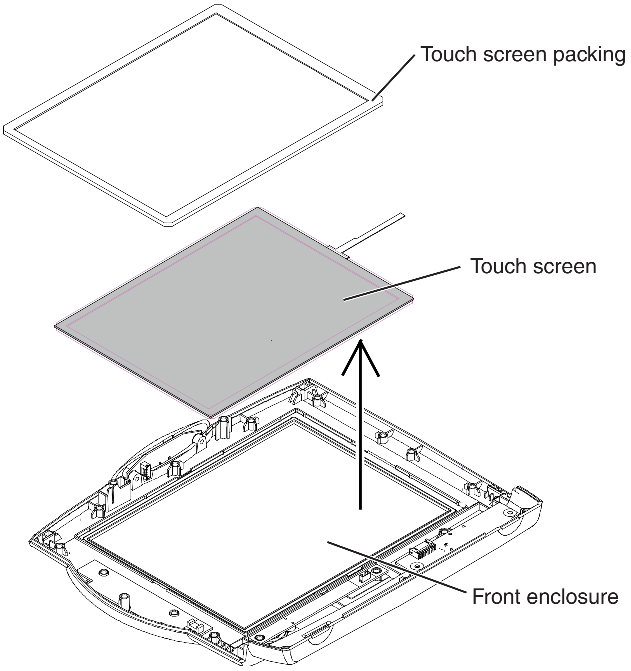
3. Remove the two PSW3 × 6 screws of (1) and five PS3 × 6 screws of (2). Then remove LCD unit together with the main chassis front.


LCD unit together with main chassis front
(2) PS3 × 6 screws (×5)
(2)
PSW3 × 6 screws (×2)
(1)
(2)
(2)
(2)
Screw hole
Small circle

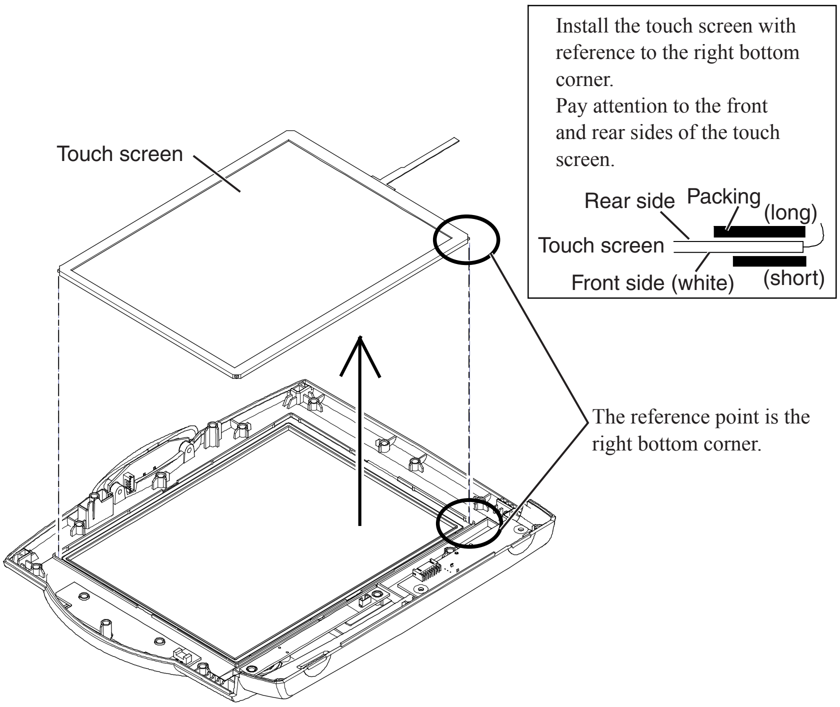
·When installing, set LCD unit with reference to the left bottom corner.
· Fix the screws into the seven holes marked with small circles.

The reference point is the left bottom corner.

4. Remove the touch screen from the front enclosure and the touch screen packing from the touch screen.


Touch screen packing
Touch screen
Front enclosure

5. When installing, place the touch screen with its rear side up, pass the cable of the touch screen through the packing, and attach the packing to the touch screen. Set the touch screen into the front enclosure with its rear side up and with reference to the right bottom corner.


Install the touch screen with reference to the right bottom corner.
Pay attention to the front and rear sides of the touch screen.

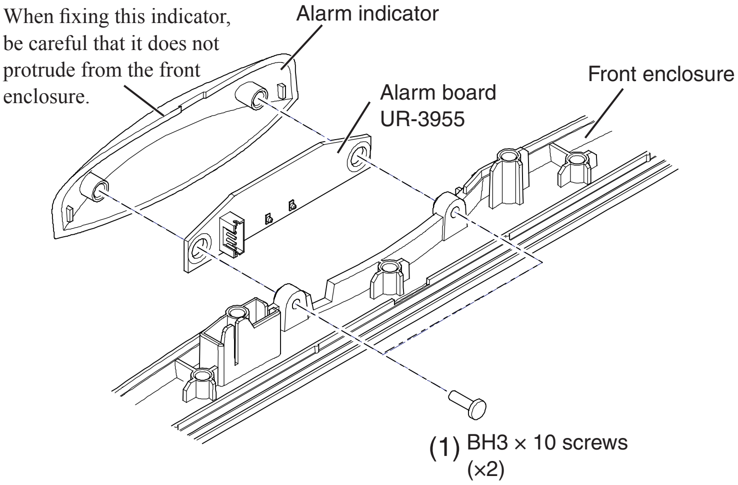
Touch screen
Rear side
Packing
(long)
Touch screen
Front side (white)
(short)

The reference point is the right bottom corner.

Removing the ALARM Board (UR-3955)

1. Remove the rear enclosure and separate the front and rear sections. Then remove LCD unit together with the main chassis. For details, refer to steps 1 to 3 of “Replacing the Touch Screen”.

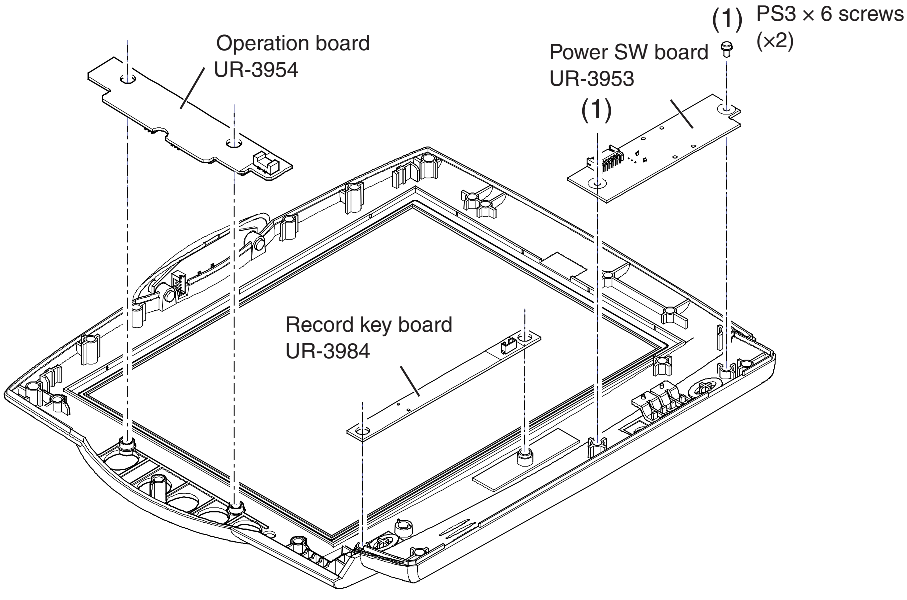
2. Remove the two BH3 × 10 screws of (1). Then remove the alarm indicator and alarm board (UR-3955) from the front enclosure.


When fixing this indicator, be careful that it does not protrude from the front enclosure.
Alarm indicator
Alarm board
UR-3955
Front enclosure
(1) BH3 × 10 screws
(×2)

Removing the Operation Board, Record Key Board and Power SW Board (UR-3954/3984/3953)

1. Remove the rear enclosure and separate it from the front section. Then remove the LCD unit together with the main chassis. For details, refer to steps 1 to 3 of “Replacing the Touch Screen”.

2. Remove the two PS3 × 6 screws of (1) and power SW board (UR-3953). Remove the record key board (UR-3984) and operation board (UR-3954) which are mounted on protrusions of the front enclosure.


(1) PS3 × 6 screws
(×2)
Operation board
UR-3954
Power SW board
UR-3953
(1)
Record key board
UR-3984

Disassembling the Main Unit (MU-651R/671R)

CAUTION

- Before performing replacement, be sure to turn off the power switch.
- Disconnect the power cord and the connection cables.
- When replacing the boards, be sure to confirm the dip switch settings.

Tools required: A Phillips-head screwdriver* (for M3 and M4), a flathead screwdriver, hexagon wrenches (5), and tweezers

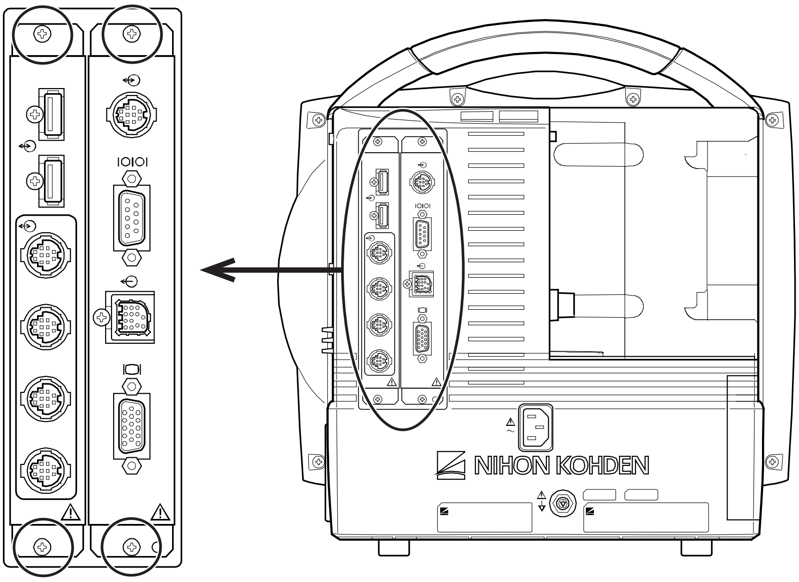
* The shaft of the Phillips-head screwdriver must be at least 10 cm long to remove the power supply unit.

Removing the Rear Enclosure

Removing the Optional Interfaces (QI-671P/672P)

Remove the optional QI-671P and QI-672P interfaces if installed.

1. Remove the four BH3 × 6 screws.

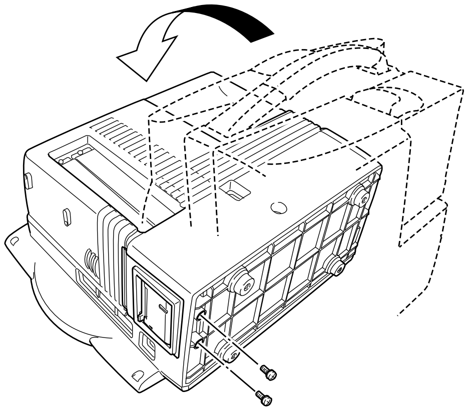


2. Insert the flathead screwdriver between the two optional boards and pull them out.

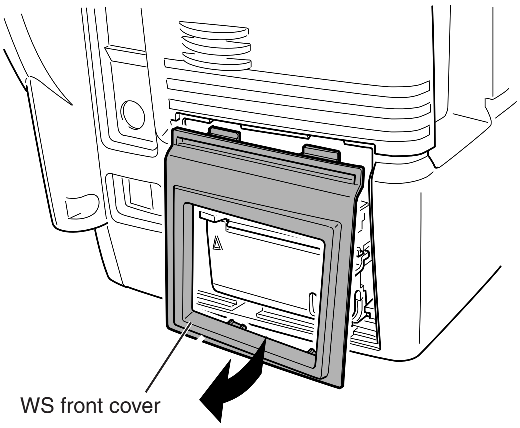
Removing the Recorder Module (WS-671P)

Remove the WS-671P recorder module if installed.

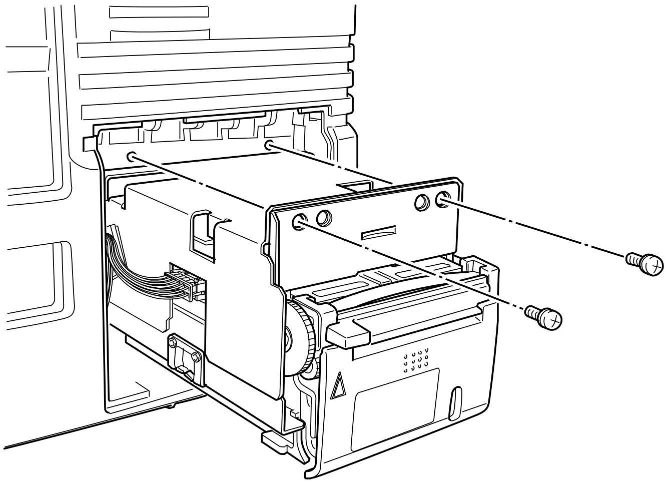
1. Lay the monitor face down and remove the two BH3 × 6 screws from the bottom of the bedside monitor.



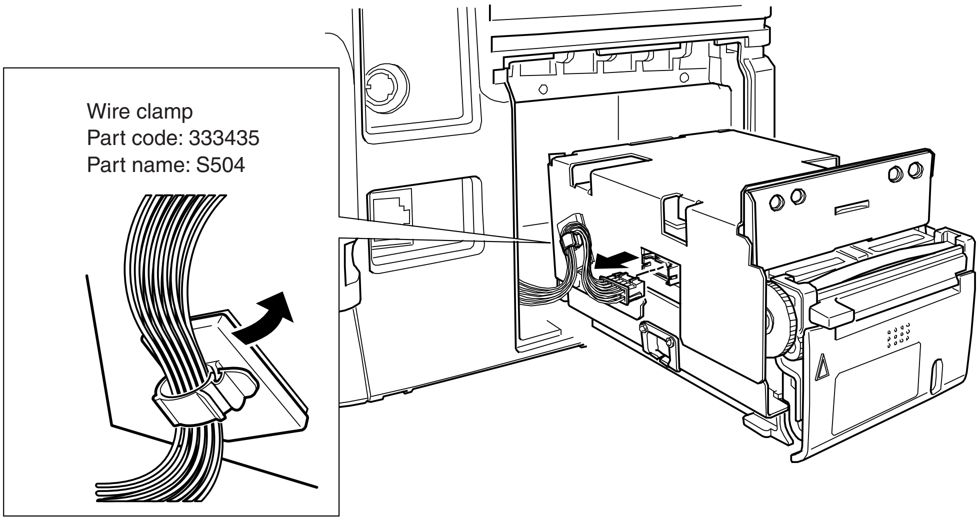
2. Remove the WS front cover.



3. Remove the two PS3 × 6 screws fixing the recorder module to the bedside monitor.



4. Pull out the the recorder module. Remove the internal cable from the wire clamp and from the connector connected to the recorder module.


Wire clamp
Part code: 333435
Part name: S504

Removing the Handle

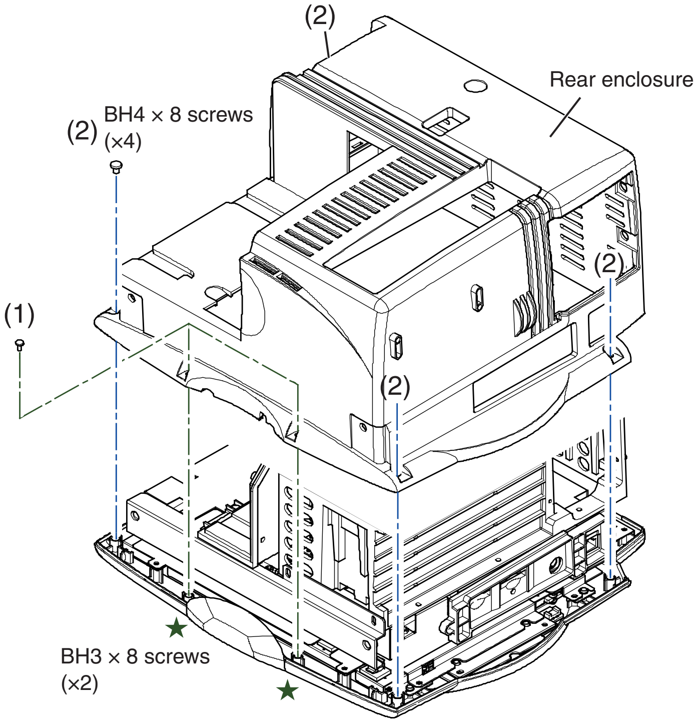
Use the flathead screwdriver to remove the two screw covers from the right and left ends of the handle. Use the hexagon wrench to remove the two M6 × 16 hexagon screws. Then remove the handle. For details, see "Removing the Handle."

Removing the Rear Enclosure

MU-651R

1. Lay the monitor face down.

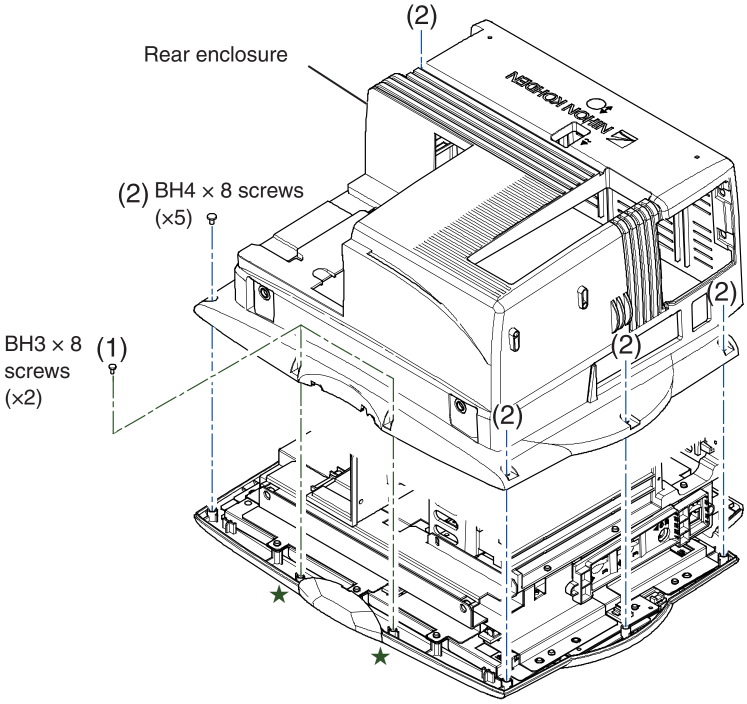
2. Remove the two BH3 × 8 screws of (1) and the four BH4 × 8 screws of (2) from the rear side of the unit.


(2)
Rear enclosure
(2) BH4 × 8 screws (×4)
(2)
(1)
(2)
★
BH3 × 8 screws (×2)
★

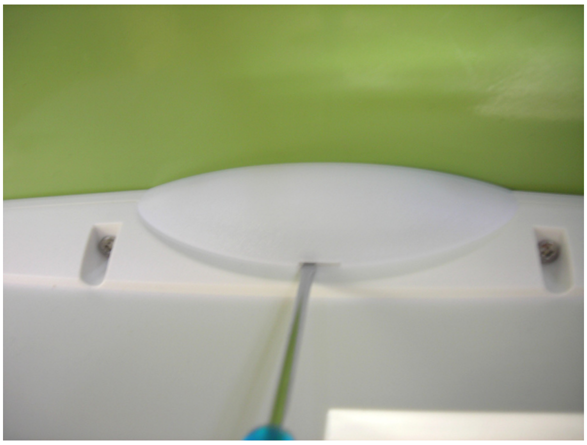
MU-671R

1. Lay the monitor face down.

2. Remove the two BH3 × 8 screws of (1) and five BH4 × 8 screws of (2) from the rear side of the monitor.


(2)
Rear enclosure
(2) BH4 × 8 screws (×5)
BH3 × 8 screws (×2)
(1)
(2)
(2)
(2)
★
★

3. On MU-651R or MU-671R, insert the flathead screwdriver between the alarm indicator and the rear enclosure, and remove the rear enclosure.



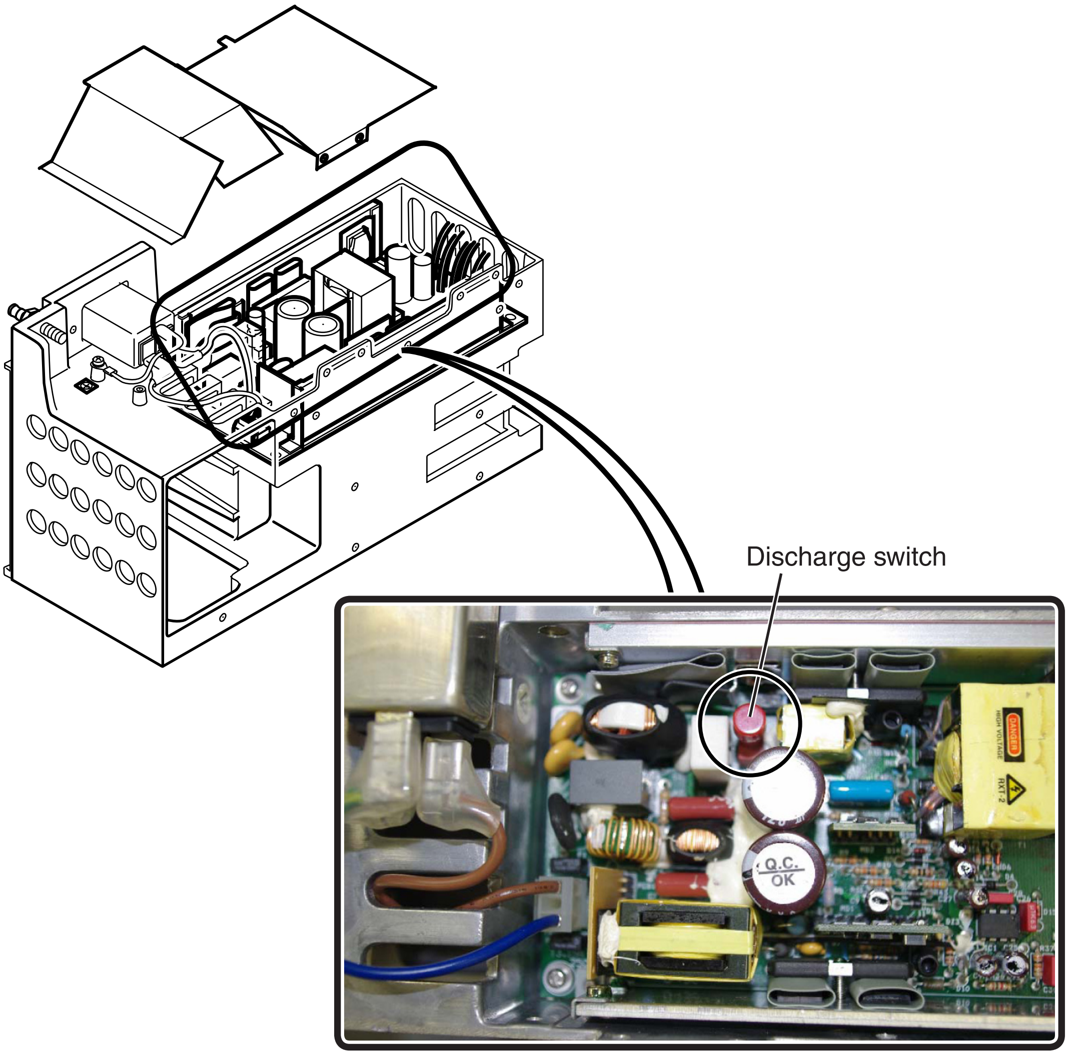
Removing the SC-671R Power Unit from the Heat Sink Block

CAUTION

Before starting the maintenance work, pull out the power cord from the unit and press the red discharge switch in the figure below. Be careful not to touch the conductive areas around the switch with your finger.

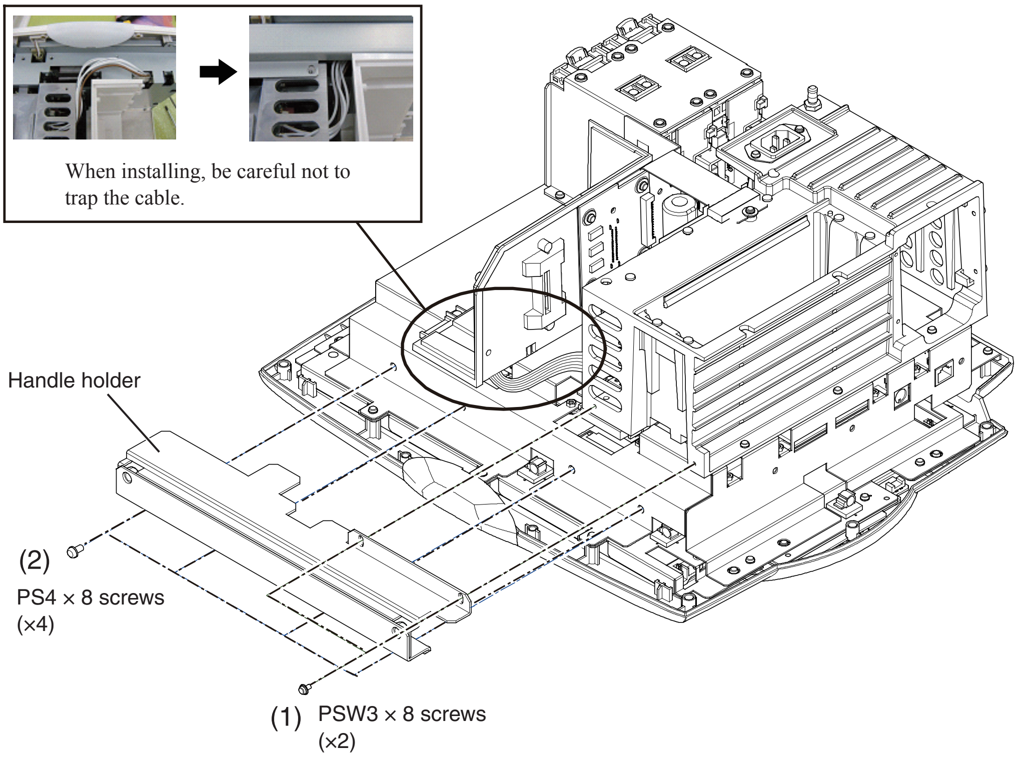
CAUTION

Never press the red discharge switch before pulling out the power cord.



1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

2. Remove the two PSW3 × 8 screws of (1) and the four PS4 × 8 screws of (2). Then remove the handle holder.

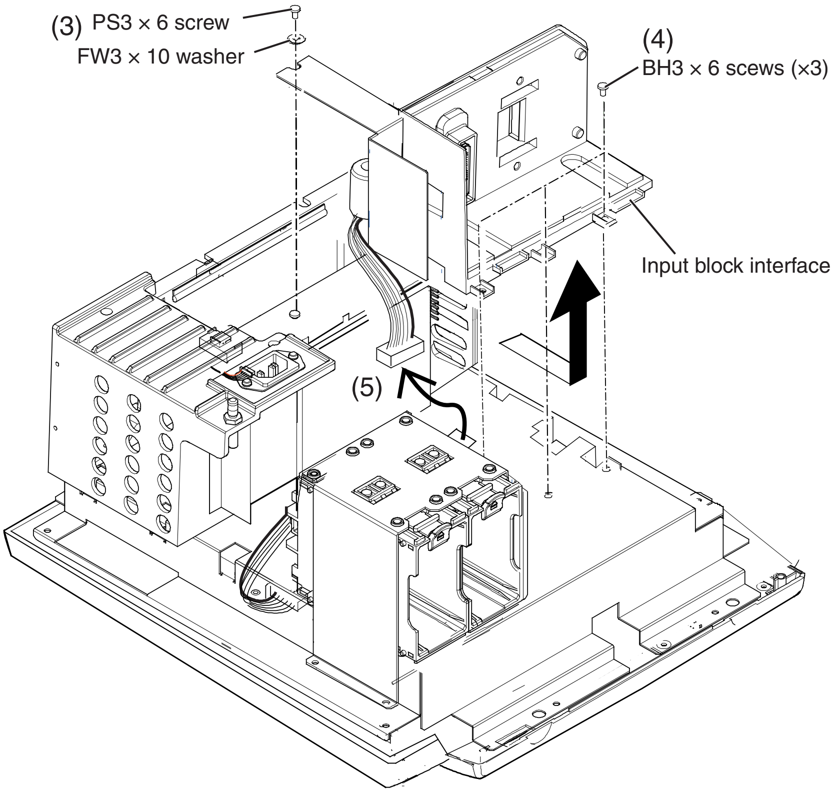


When installing, be careful not to trap the cable.

Handle holder
(2)
PS4 × 8 screws
(×4)
(1)
PSW3 × 8 screws
(×2)

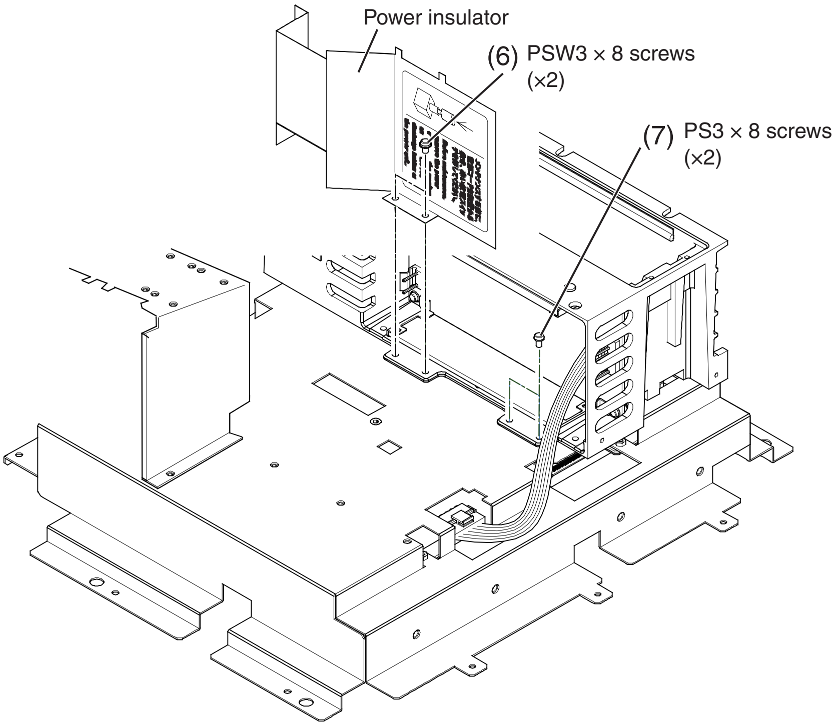
3. Remove the PS3 × 6 screw and the FW3 × 10 BSBM washer of (3) and the three BH3 × 6 screws of (4). Slide the input block interface in the direction indicated with the arrow and lift it upward.

4. Remove the cable connector of (5) from the MAIN DIGITAL board and remove the input block interface.

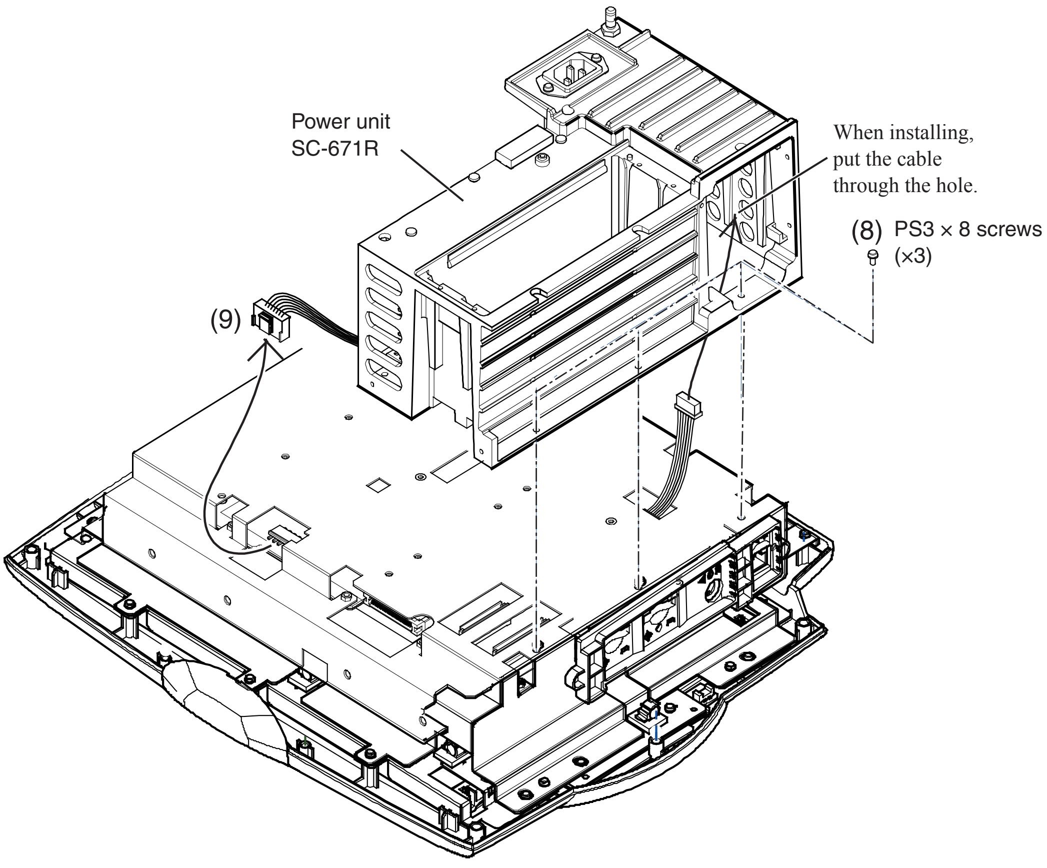


(3) PS3 × 6 screw
FW3 × 10 washer
(4)
BH3 × 6 scews (×3)
Input block interface
(5)

5. Remove the two PSW3 × 8 screws of (6) and the power insulator covering the power unit. Then remove the two PS3 × 8 screws of (7).


Power insulator
(6) PSW3 × 8 screws (×2)
(7) PS3 × 8 screws (×2)

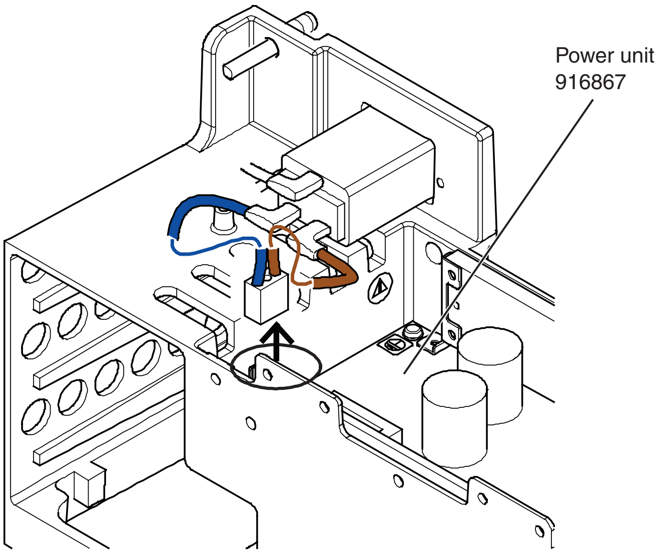
6. Remove the three PS3 × 8 screws of (8). Disconnect the power supply cable of (9) from the MAIN DIGITAL board and remove the power unit (SC-671R).


Power unit SC-671R
When installing, put the cable through the hole.
(8) PS3 × 8 screws (×3)
(9)

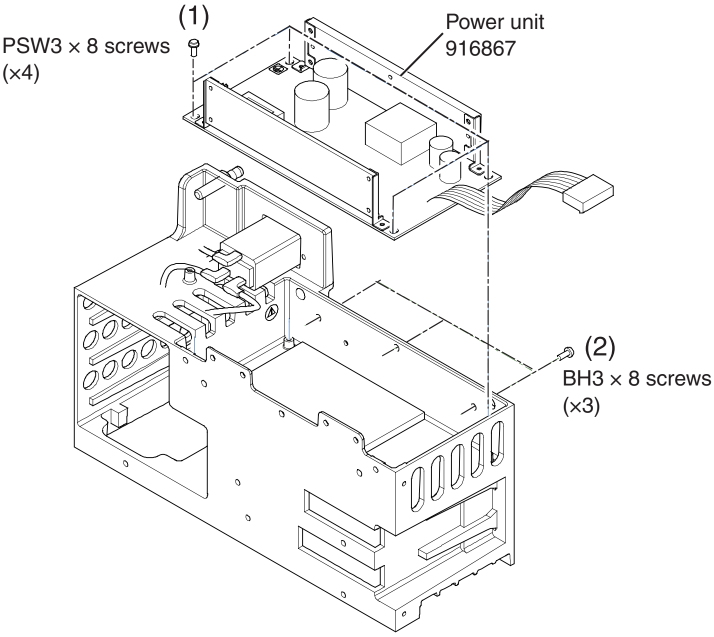
Removing the 916867 Power Unit

1. Remove the power unit. For details, refer to “Removing the SC-671R Power Unit from the Heat Sink Block”.

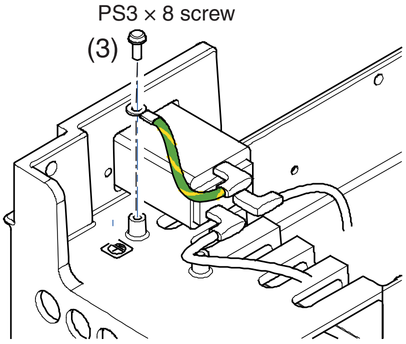
2. Disconnect the cable connecting the AC inlet and the 916867 power unit from the SC-671R power unit.


Power unit
916867

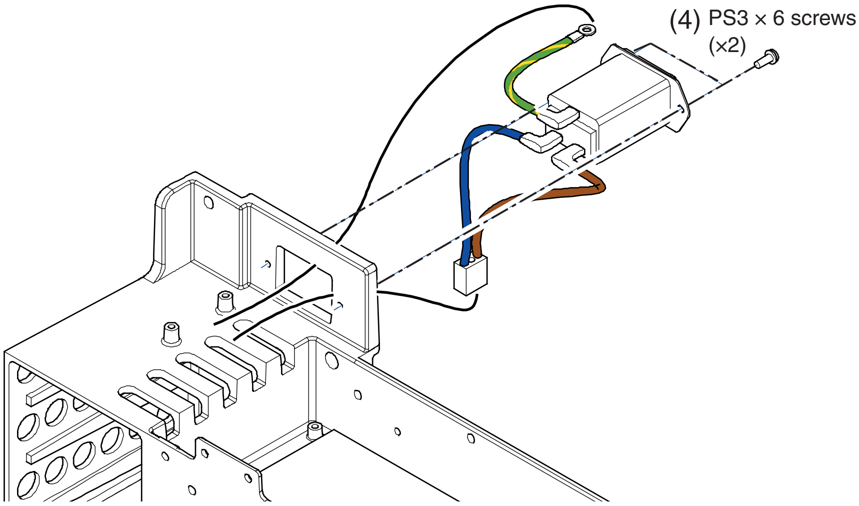
3. Remove the four PSW3 × 8 screws of (1) and three BH3 × 8 screws of (2). Then lift and remove the power unit (916867).


(1)
PSW3 × 8 screws
(×4)
Power unit
916867
(2)
BH3 × 8 screws
(×3)

4. Remove the PS3 × 8 screw of (3) and remove the protective ground conductor.

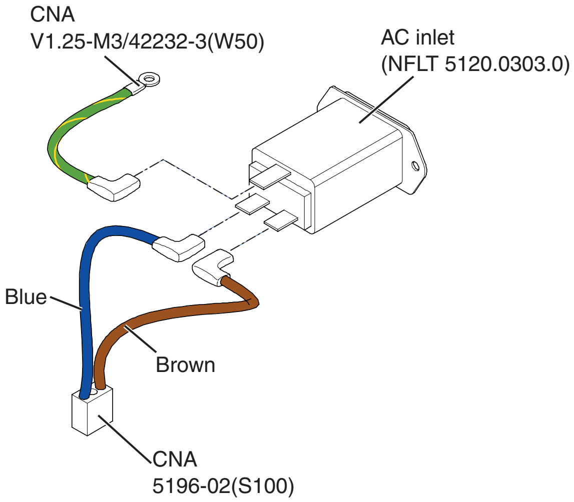

PS3 × 8 screw
(3)

5. Remove the two PS3 × 6 screws of (4) and the AC inlet.


(4) PS3 × 6 screws
(×2)

NOTE

Pay attention to the cable colors while installing the AC inlet.


CNA
V1.25-M3/42232-3(W50)
AC inlet
(NFLT 5120.0303.0)
Blue
Brown
CNA
5196-02(S100)

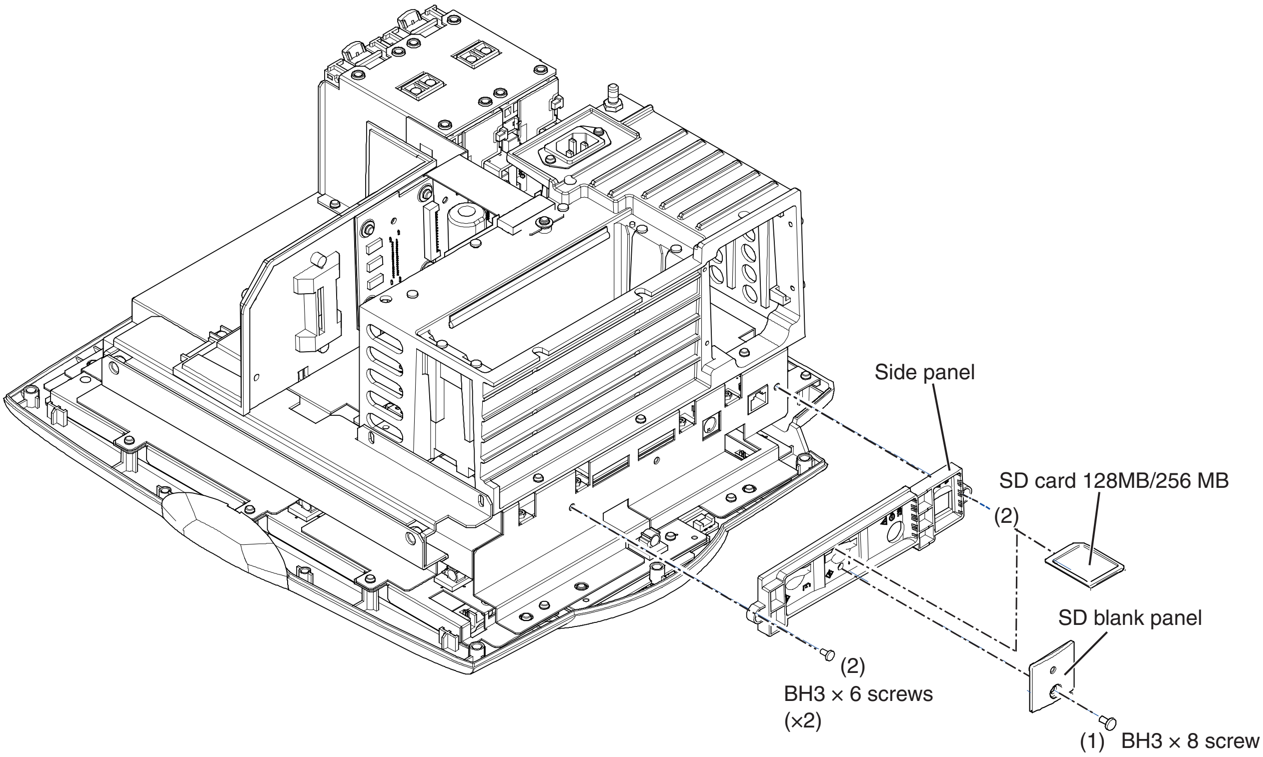
Replacing the MAIN DIGITAL Board (UR-3945/39451)

NOTE

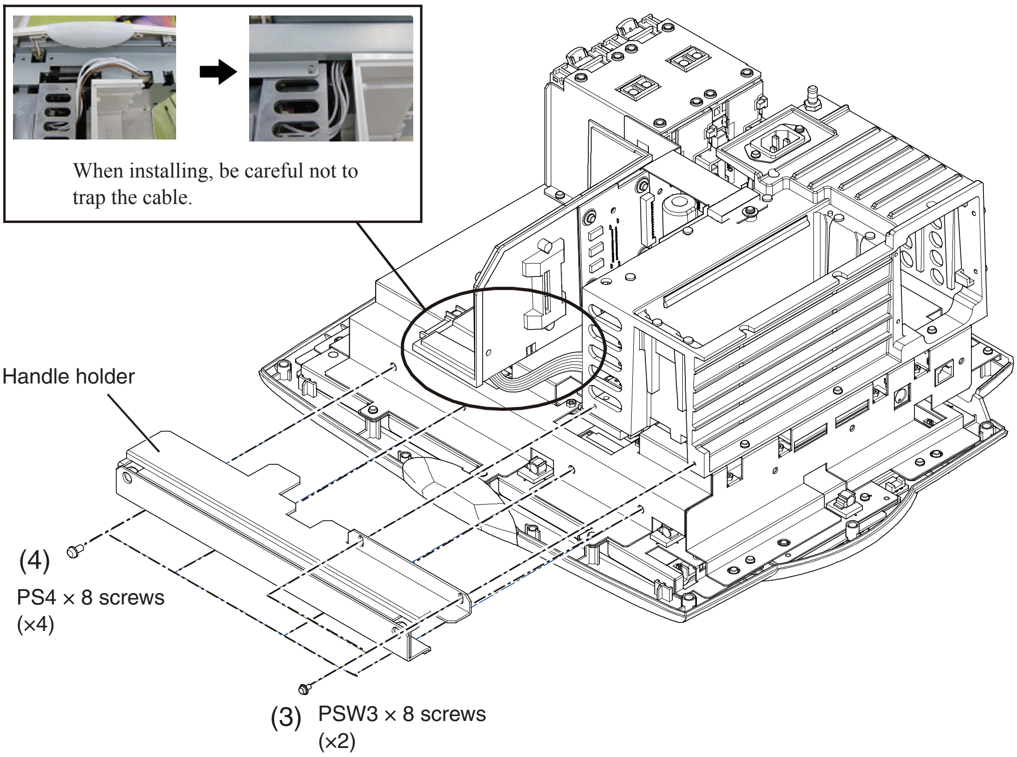
After replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to the “Calibrating the Touch Panel” in Section 3.

1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

2. Remove the BH3 × 8 screw of (1) and two BH3 × 6 screws of (2). Then remove the SD blank panel and side panel and pull out the SD card.


Side panel
SD card 128MB/256 MB
(2)
SD blank panel
(2)
BH3 × 6 screws
(×2)
(1) BH3 × 8 screw

3. Remove the two PSW3 × 8 screws of (3) and the four PS4 × 8 screws of (4). Then remove the handle holder.

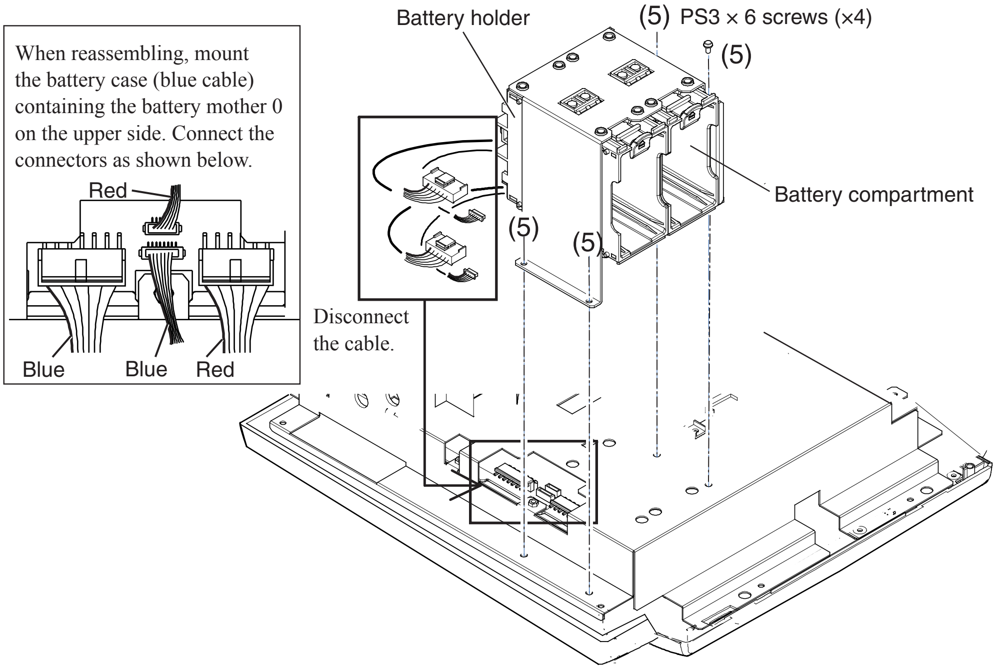


When installing, be careful not to trap the cable.

Handle holder
(4)
PS4 × 8 screws
(×4)
(3)
PSW3 × 8 screws
(×2)

4. Remove the SC-671R power unit. For details, refer to “Removing the SC-671R Power Unit”.

5. Remove the four PS3 × 6 screws of (5) and remove the battery holder together with the battery compartment.



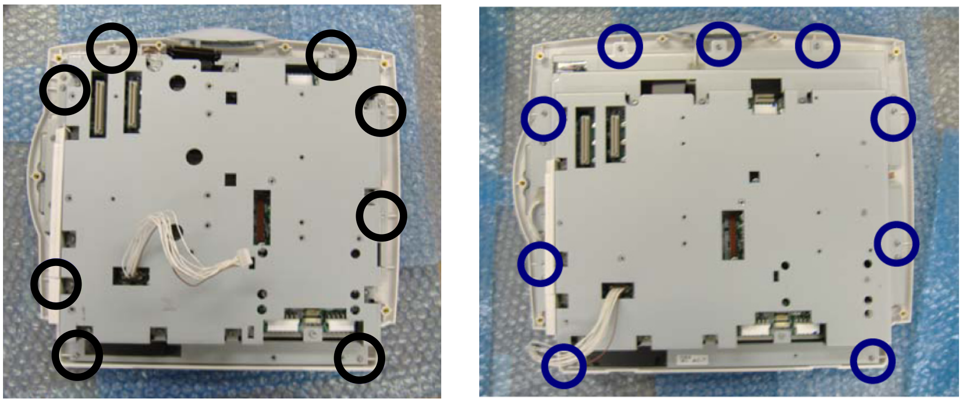
When reassembling, mount the battery case (blue cable) containing the battery mother 0 on the upper side. Connect the connectors as shown below.

Disconnect the cable.

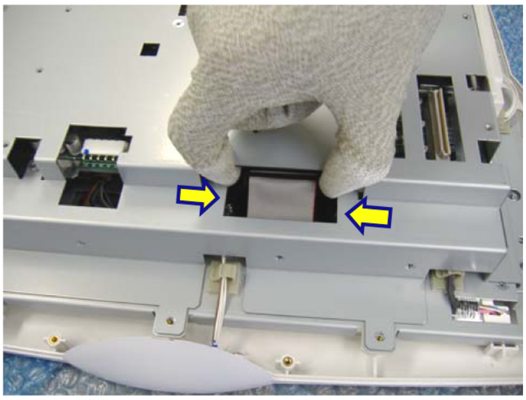
Red
Blue
Blue
Red
Battery holder
(5) PS3 × 6 screws (×4)
(5)
Battery compartment
(5)
(5)

6. Remove the eight PS3 × 6 screws for MU-651R, or the nine screws for MU-671R.

MU-651R **MU-671R**



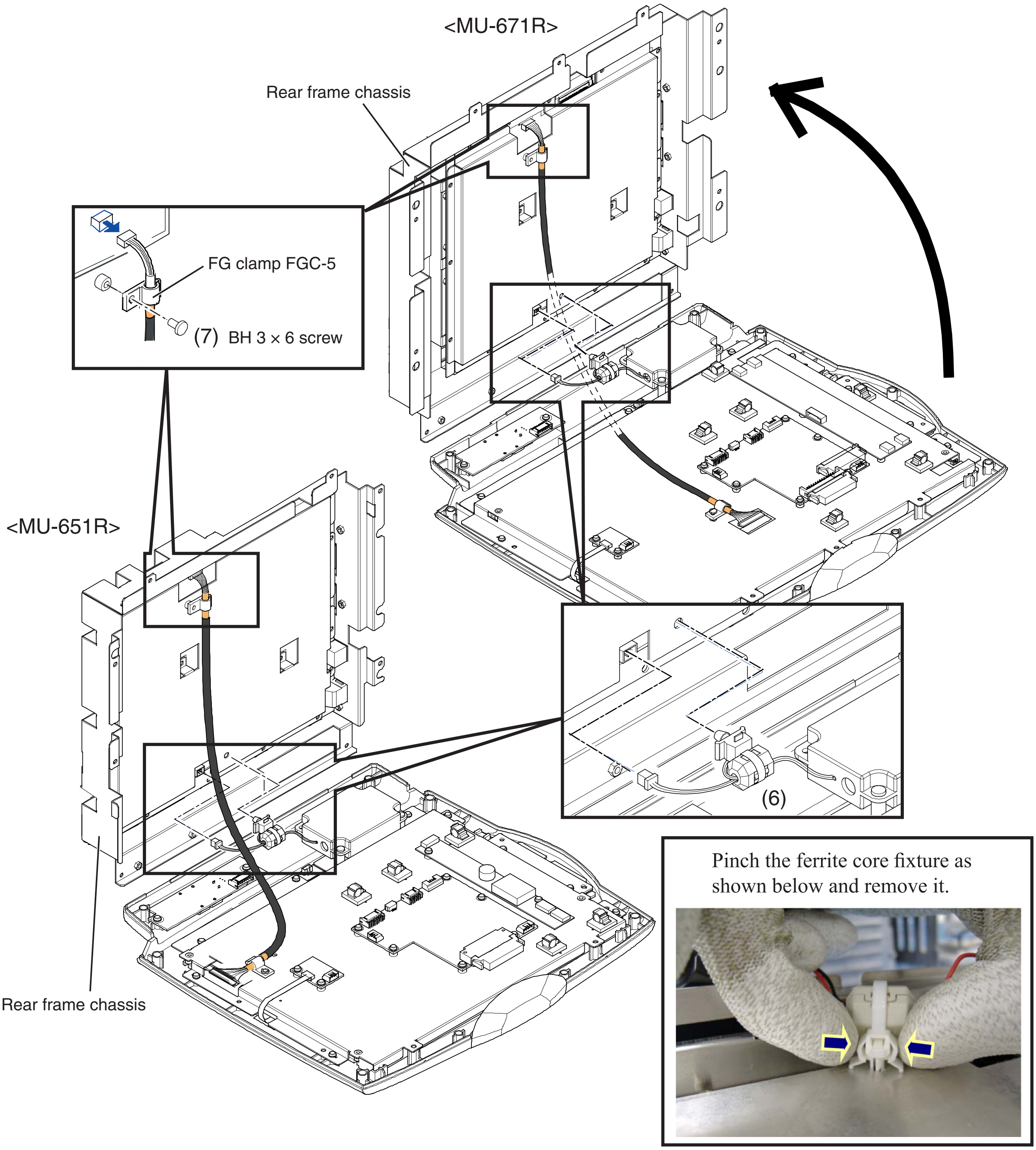
7. Pinch the cable connector in the direction of the arrows shown below to release the lock. Remove the flat cable from the MAIN DIGITAL board connector.



8. Lift the rear frame chassis with attention paid to the internal wiring connecting the MAIN DIGITAL board and LCD.

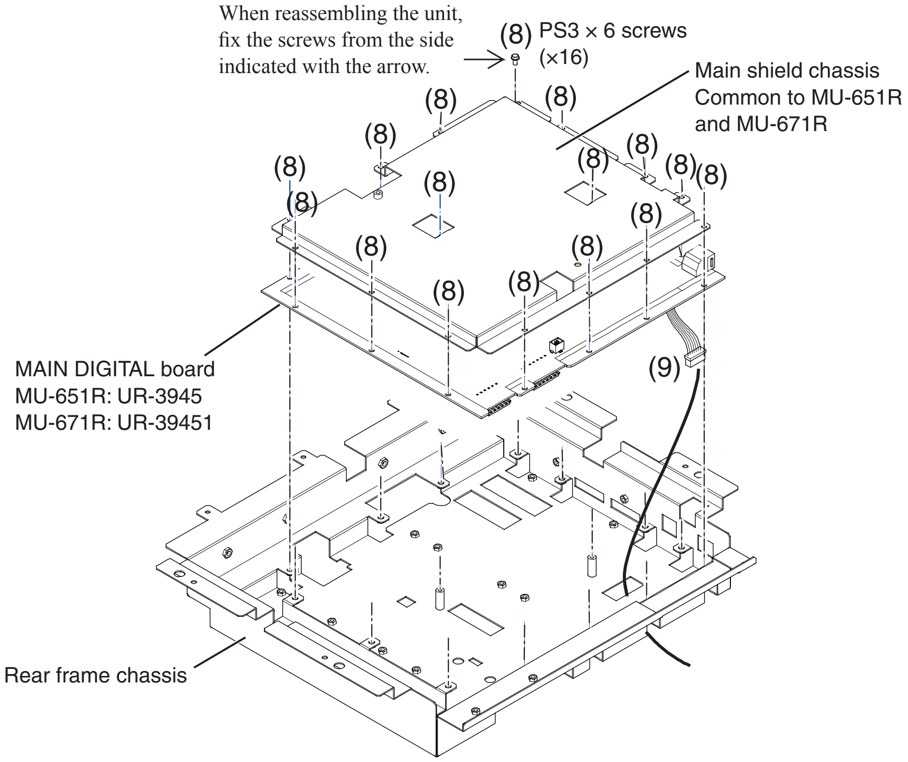
9. Pinch and remove the ferrite core fixture of (6) and disconnect the cable connecting the speaker from the MAIN DIGITAL board.

10. Remove the BH3 × 6 screw of (7) that fixes the FG clamp. Then remove the cable connector connecting the LCD unit from the MAIN DIGITAL board.

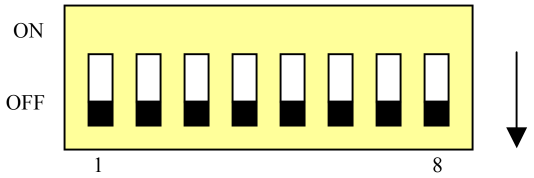

<MU-671R>
Rear frame chassis
FG clamp FGC-5
(7) BH 3 × 6 screw
<MU-651R>
(6)
Rear frame chassis

Pinch the ferrite core fixture as shown below and remove it.

11. Remove the sixteen PS3 × 6 screws of (8) and lift and remove the main shield chassis. Remove the connector of (9) and remove the MAIN DIGITAL board from the rear frame chassis.


When reassembling the unit, fix the screws from the side indicated with the arrow.
(8) PS3 × 6 screws (×16)
Main shield chassis Common to MU-651R and MU-671R
(8)
(9)
MAIN DIGITAL board
MU-651R: UR-3945
MU-671R: UR-39451
Rear frame chassis

Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-3945/39451)



Bits 1 to 8 of the S17100 DIP switch on the board must be set to OFF.

Removing the FRONT IF Board (UR-3956)

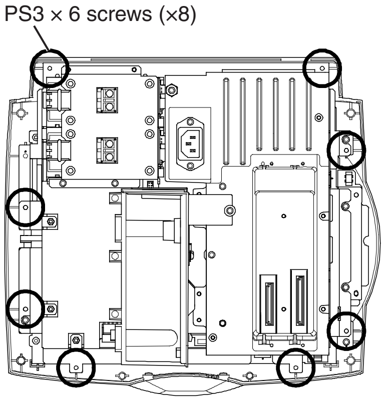
1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

2. Remove the BH3 × 8 screw and the two BH3 × 6 screws. Then remove the SD blank panel and side panel and pull out the SD card. For details, refer to step 2 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.

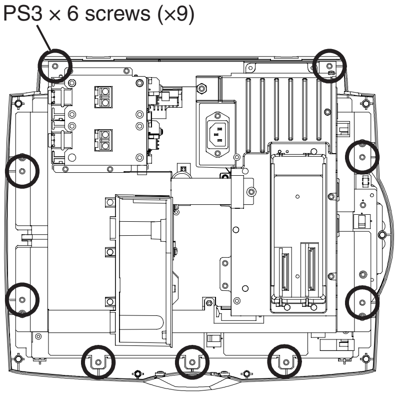
3. Remove the two PSW3 × 8 screws and four PS4 × 8 screws. Then remove the handle holder. For details, refer to step 3 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.

4. Remove the eight screws for MU-651R or nine PS3 × 6 screws for MU-671R. Positions of screws are indicated in the figures below.

MU-651R



MU-671R

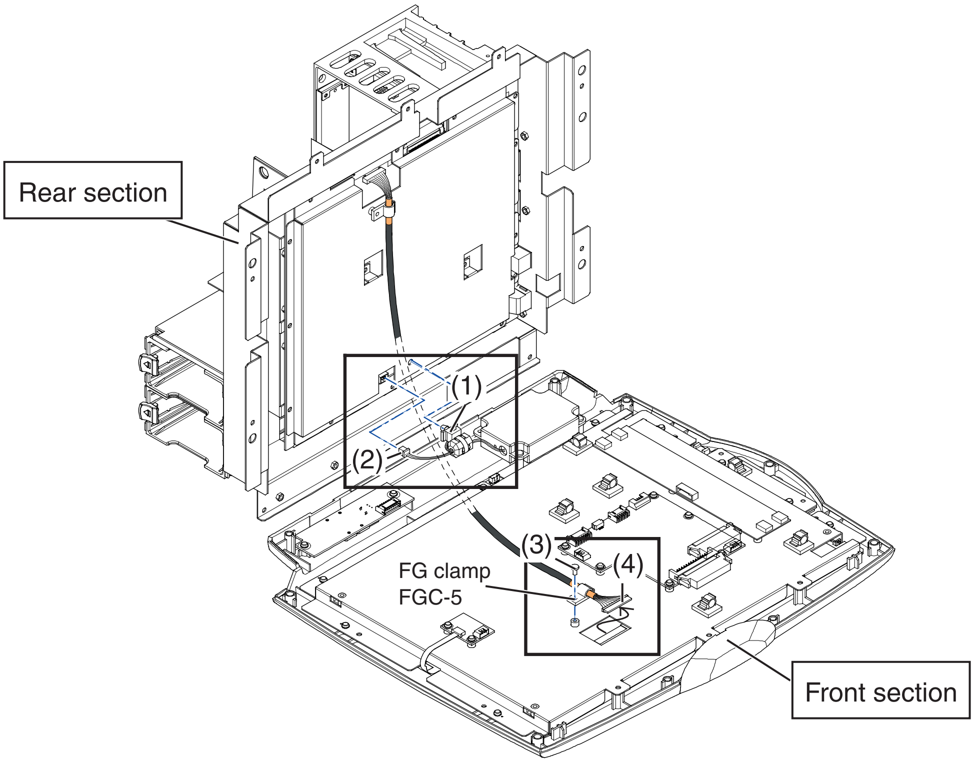


5. Remove the flat cable from the main board connector. For details, refer to step 7 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.

6. Lift the rear frame chassis with attention paid to the internal wiring connecting the MAIN DIGITAL board and LCD.

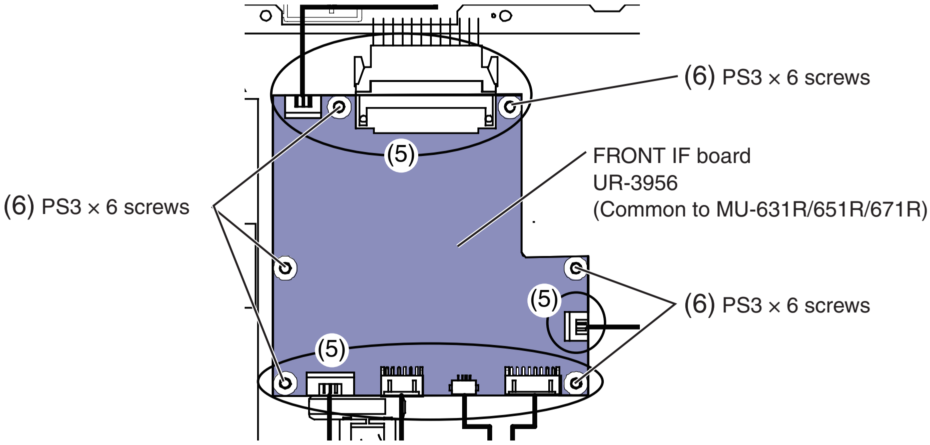
7. Pinch and remove the ferrite core fixture of (1) and disconnect the cable of (2) connecting the speaker from the MAIN DIGITAL board. Remove the BH3 × 6 screw of (3) that fixes the FG clamp and remove the cable connector of (4) connecting the MAIN DIGITAL board from the LCD unit to separate the front and rear sections.

Example: MU-671R



8. Disconnect all the seven cables of (5) from the FRONT IF board (UR-3956).

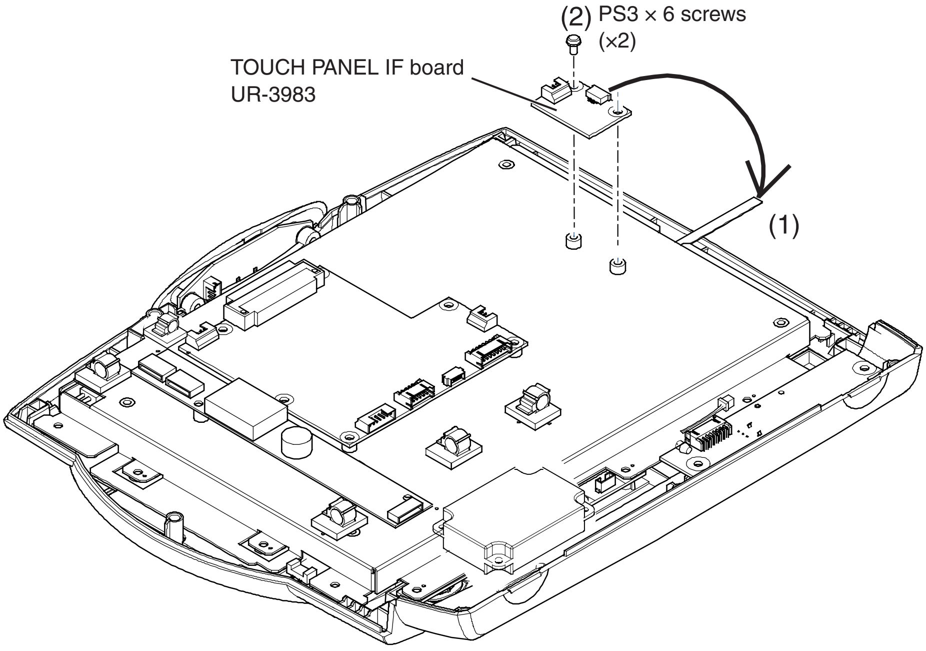
9. Remove the six PS3 × 6 screws of (6) and remove the FRONT IF board (UR-3956) from the main chassis M front or main chassis MH front.


(6) PS3 × 6 screws
(5)
FRONT IF board
UR-3956
(Common to MU-631R/651R/671R)
(6) PS3 × 6 screws
(6) PS3 × 6 screws
(5)
(5)

Removing the TOUCH PANEL IF Board (UR-3983)

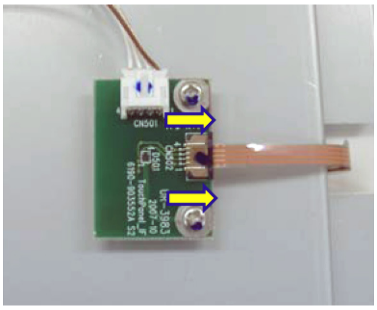
1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.

2. Remove the touch screen cable of (1) and two PS3 × 6 screws of (2). Then remove the TOUCH PANEL IF board from the main chassis.

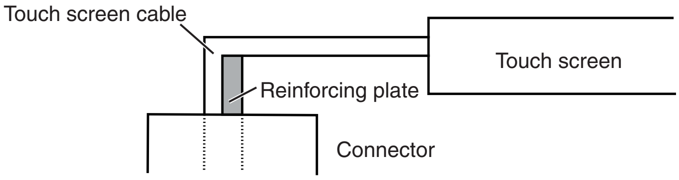

(2) PS3 × 6 screws
(×2)
TOUCH PANEL IF board
UR-3983
(1)

NOTE

- When removing the touch screen cable of (1), slide the black part of the connector.



- Do not fold or bend the touch screen cable. The cable may break. On the connector insertion part, the reinforcing plate is attached. Take care to avoid excessive force while inserting the connector. Unnecessary removal and insertion of the connector may damage the touch screen.

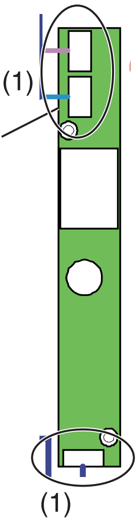

Touch screen cable
Touch screen
Reinforcing plate
Connector

Removing the Inverter

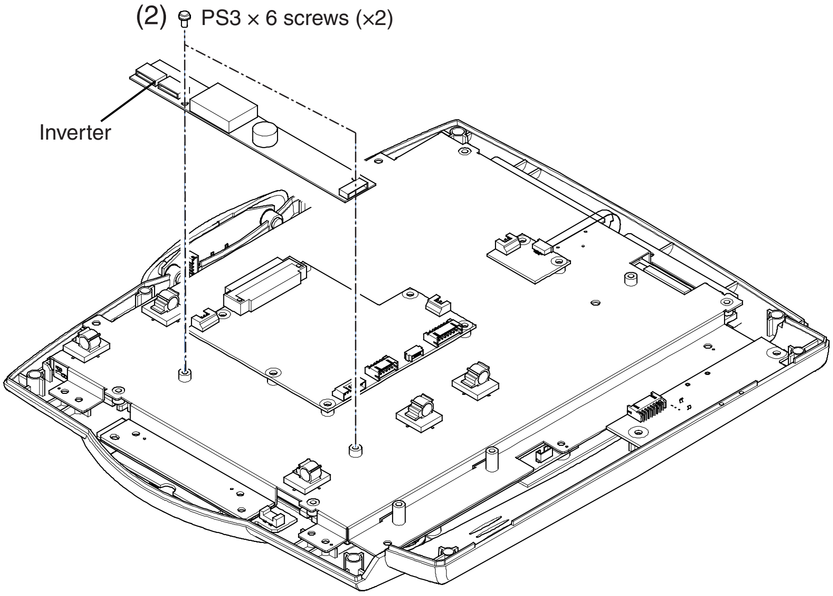
MU-651R

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.

2. Remove the three cables of (1) and two PS3 × 6 screws of (2). Then remove the inverter from the main chassis front.



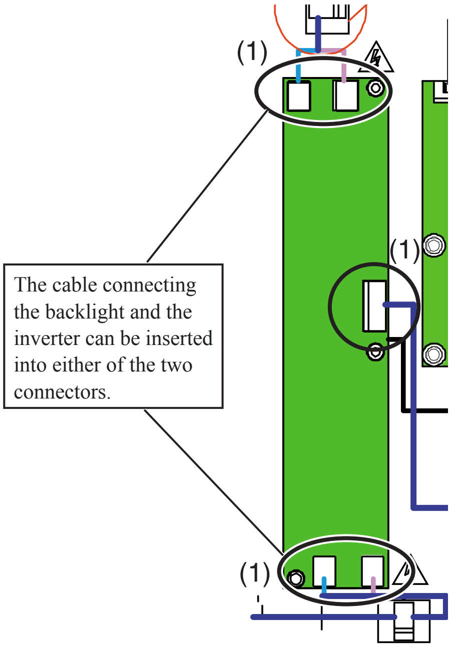
The cable connecting the backlight and the inverter can be inserted into either of the two connectors.


(2) PS3 × 6 screws (×2)
Inverter

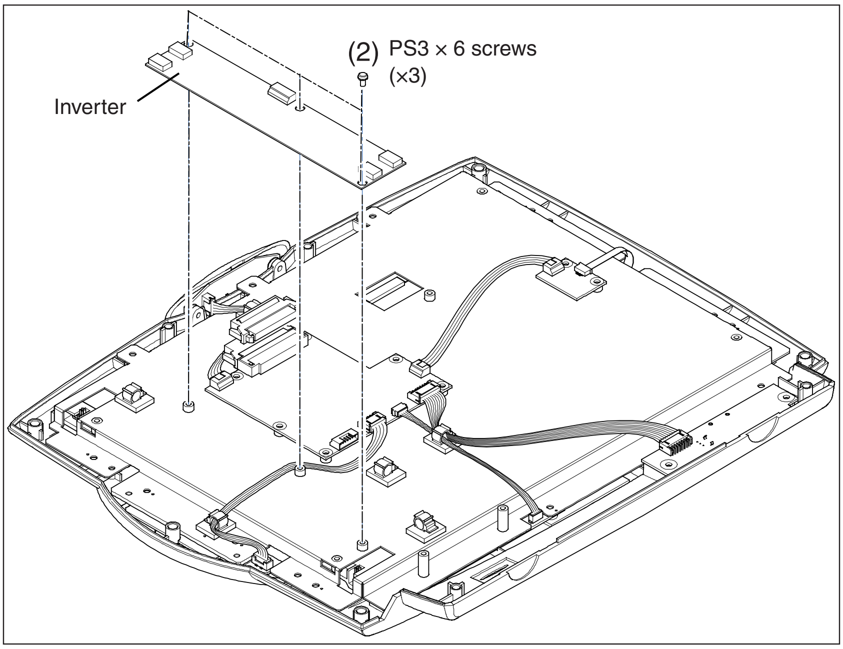
MU-671R

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.

2. Remove the five cables of (1) and the three PS3 × 6 screws of (2). Then remove the inverter from the main chassis front.



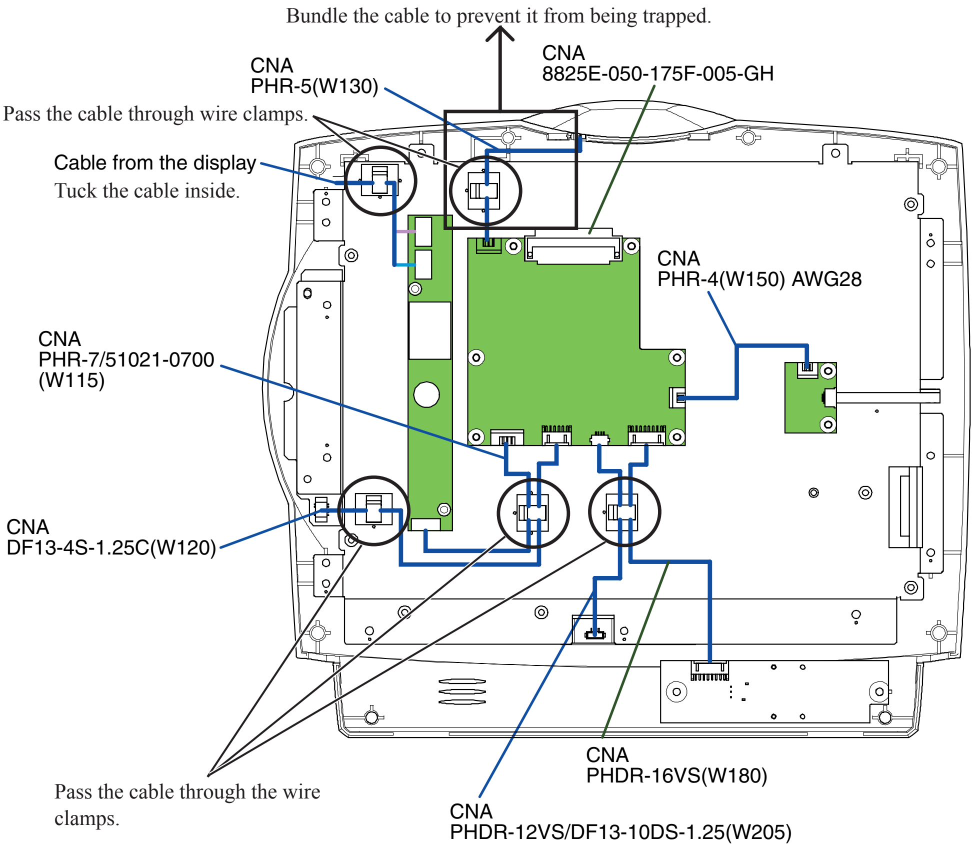
The cable connecting the backlight and the inverter can be inserted into either of the two connectors.


(2) PS3 × 6 screws
(×3)
Inverter

NOTE

Take care of the following when installing the boards and cables.

MU-651R


CNA
PHR-5(W130)
CNA
8825E-050-175F-005-GH
Cable from the display
CNA
PHR-4(W150) AWG28
CNA
PHR-7/51021-0700
(W115)
CNA
DF13-4S-1.25C(W120)
CNA
PHDR-16VS(W180)
CNA
PHDR-12VS/DF13-10DS-1.25(W205)

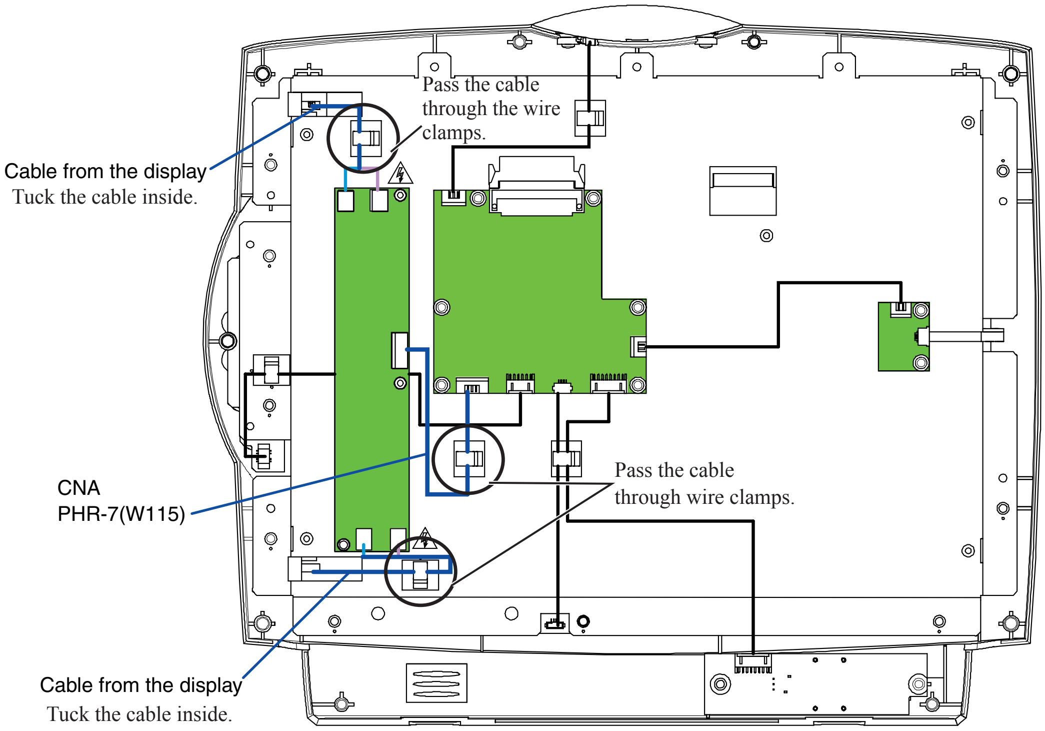
Bundle the cable to prevent it from being trapped.

Pass the cable through wire clamps.

Tuck the cable inside.

Pass the cable through the wire clamps.

MU-671R

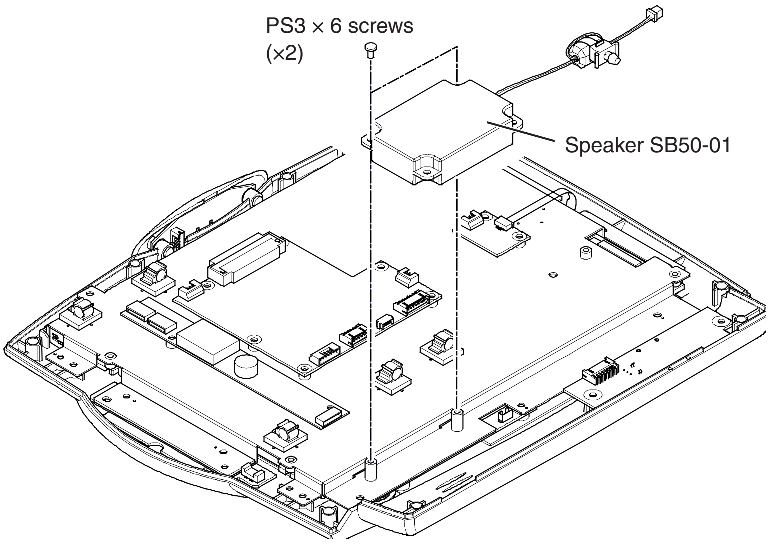

Pass the cable through the wire clamps.
Cable from the display
Tuck the cable inside.
CNA
PHR-7(W115)
Pass the cable through wire clamps.
Cable from the display
Tuck the cable inside.

- Wire clamp Part code: 379002
  Part name: S506

Removing the Speaker

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.

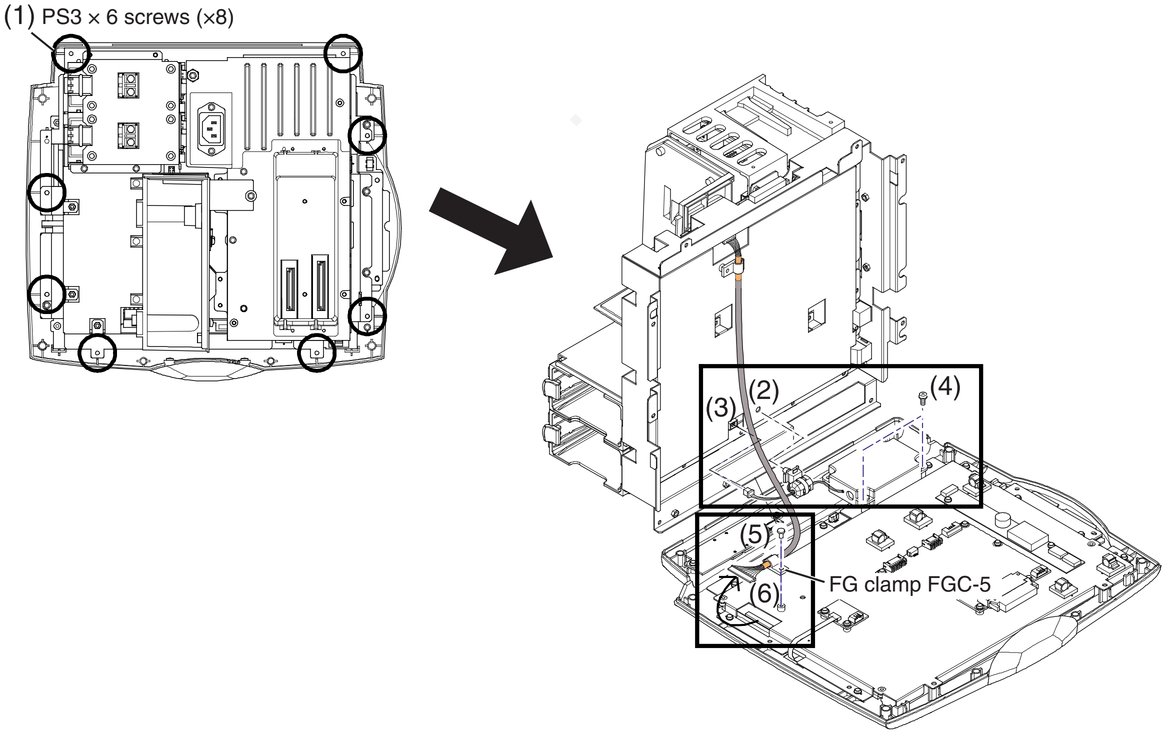
2. Remove the two BH3 × 6 screws and speaker (SB50-01).


PS3 × 6 screws
(×2)
Speaker SB50-01

Removing the LCD Unit

MU-651R

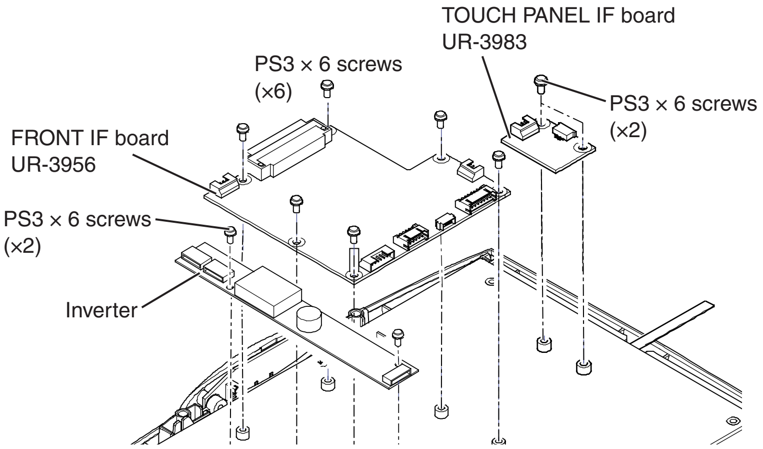
1. Remove the rear enclosure and eight PS3 × 6 screws of (1). Lift the rear frame chassis assy and remove the ferrite core fixture of (2) and the cable of (3) from the MAIN DIGITAL board (UR-3945). Then remove the PS3 × 6 screw of (4) and speaker. Remove the BH3 × 6 screw of (5) that fixes the FG clamp (FGC-5). Then remove the cable connector of (6) from the LCD unit and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.


(1) PS3 × 6 screws (×8)
(2)
(3)
(4)
(5)
(6)
FG clamp FGC-5

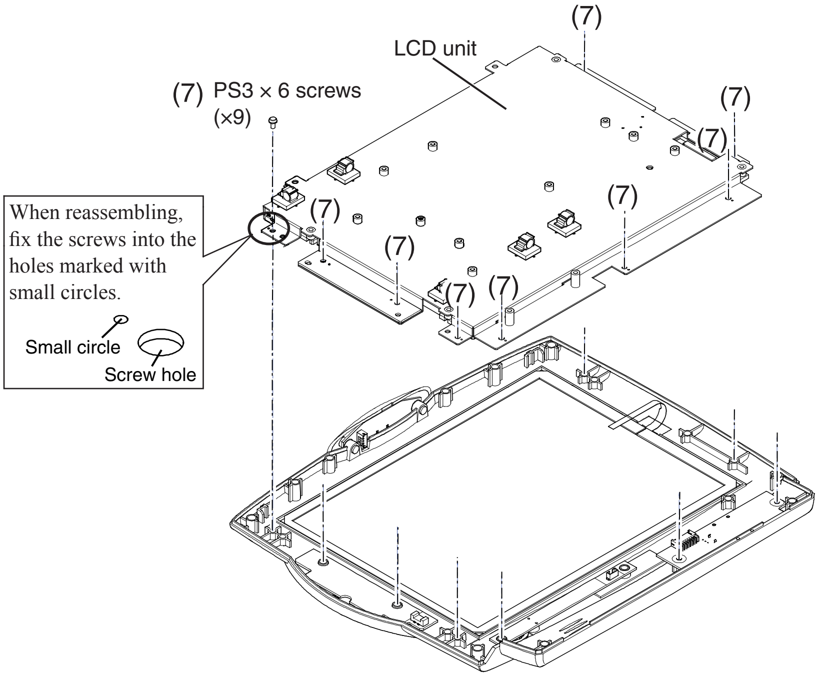
2. Remove the FRONT IF board. For details, refer to steps 8 and 9 of “Removing the FRONT IF Board (UR-3956)”.

3. Remove the TOUCH PANEL IF board. For details, refer to “Removing the TOUCH PANEL IF Board (UR-3983)”.

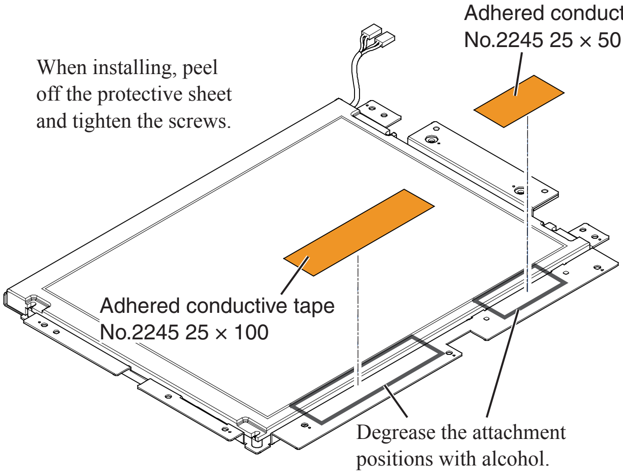
4. Remove the inverter. For details, refer to “MU-651R” of “Removing the Inverter”.

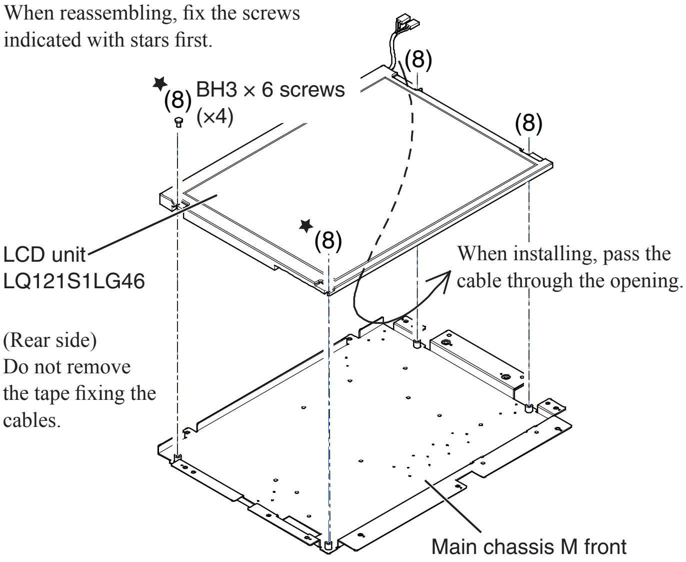

TOUCH PANEL IF board
UR-3983
PS3 × 6 screws
(×6)
PS3 × 6 screws
(×2)
FRONT IF board
UR-3956
PS3 × 6 screws
(×2)
Inverter

5. Remove the nine PS3 × 6 screws of (7).


(7)
LCD unit
(7) PS3 × 6 screws
(×9)
(7)
(7)
(7)
(7)
(7)
(7)
(7)
When reassembling, fix the screws into the holes marked with small circles.
Small circle
Screw hole

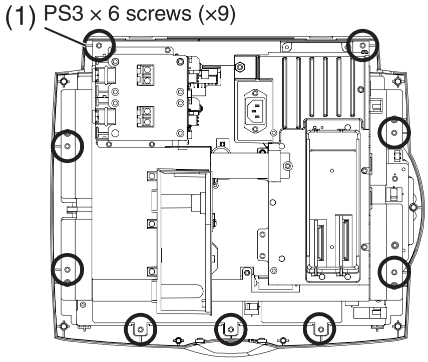
6. Turn the main chassis front upside down and peel off the two pieces of conductive tape. Remove the four BH3 × 6 screws of (8) and then lift and remove the LCD unit.

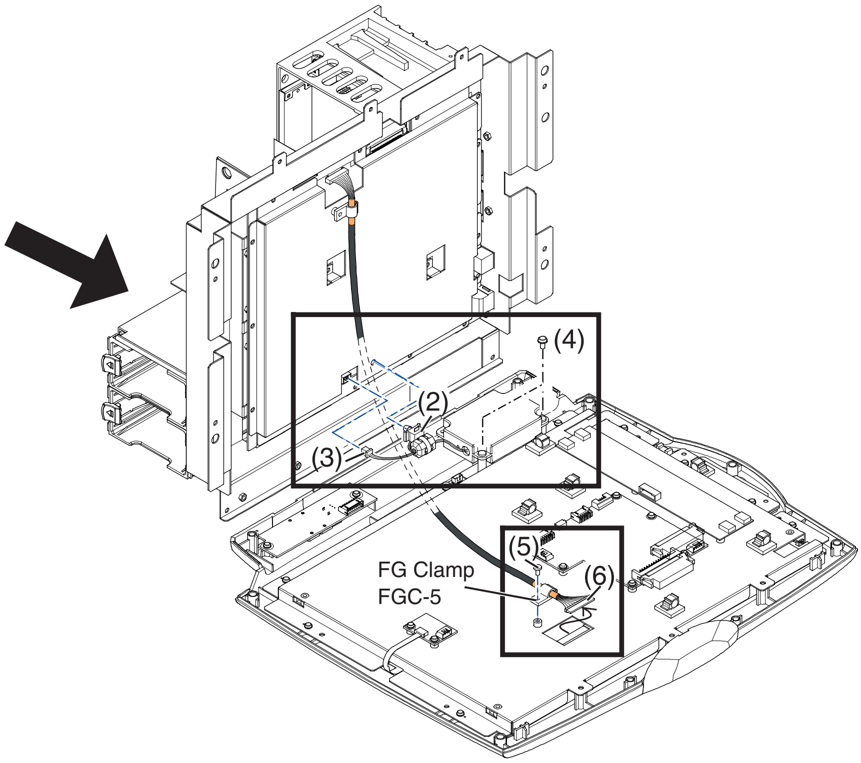

Adhered conductive tape
No.2245 25 × 50
When installing, peel off the protective sheet and tighten the screws.
Adhered conductive tape
No.2245 25 × 100
Degrease the attachment positions with alcohol.


When reassembling, fix the screws indicated with stars first.
(8)
★(8) BH3 × 6 screws
(×4)
(8)
★(8)
LCD unit
LQ121S1LG46
When installing, pass the cable through the opening.
(Rear side)
Do not remove the tape fixing the cables.
Main chassis M front

MU-671R

1. Remove the rear enclosure and nine PS3 × 6 screws of (1). Lift the rear frame chassis and remove the ferrite core fixture of (2) and cable of (3) from the MAIN DIGITAL board (UR-39451). Then remove the PS3 × 6 screw of (4) and speaker. Remove the BH3 × 6 screw of (5) that fixes the FG clamp. Then remove the cable connector of (6) from the LCD unit and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-3956)”.

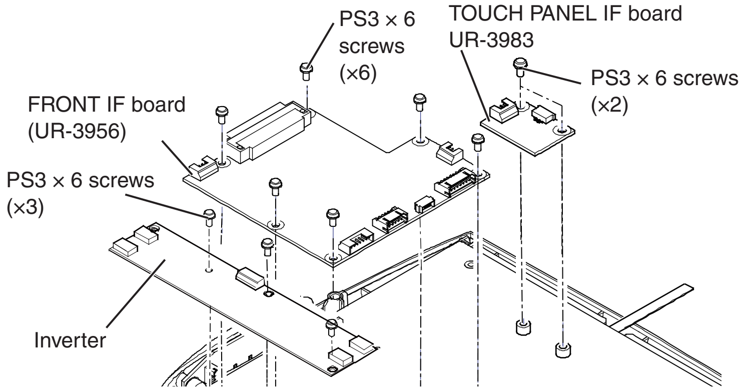

(1) PS3 × 6 screws (×9)


(4)
(2)
(3)
(5)
(6)
FG Clamp
FGC-5

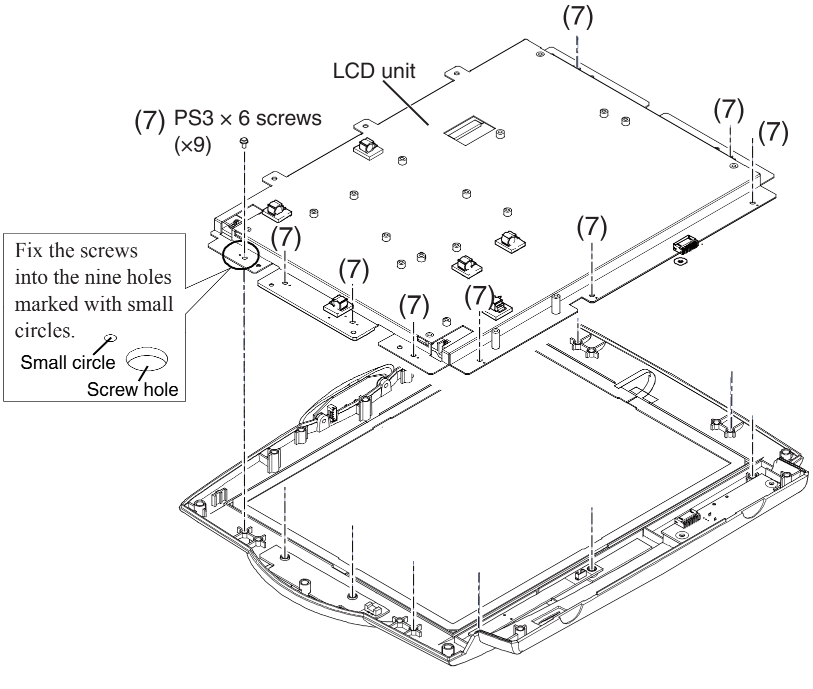
2. Remove the front IF board. For details, refer to steps 8 and 9 of “Removing the FRONT IF Board (UR-3956)”.

3. Remove the TOUCH PANEL IF board. For details, refer to “Removing the TOUCH PANEL IF Board (UR-3983)”.

4. Remove the inverter. For details, refer to “MU-671R” of “Removing the Inverter”.

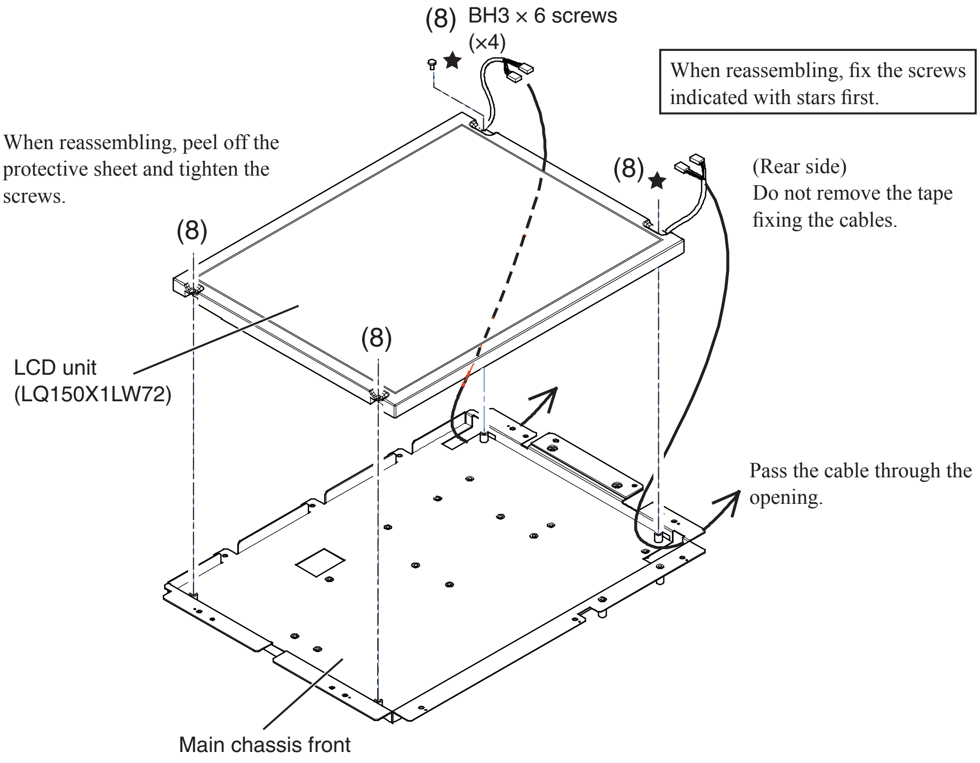

PS3 × 6 screws (×6)
TOUCH PANEL IF board UR-3983
PS3 × 6 screws (×2)
FRONT IF board (UR-3956)
PS3 × 6 screws (×3)
Inverter

5. Remove the nine PS3 × 6 screws of (7) and then lift and remove the LCD unit together with the main chassis front.


(7)
LCD unit
(7) PS3 × 6 screws
(×9)
(7)
(7)
(7)
(7)
(7)
(7)
(7)
Small circle
Screw hole

Fix the screws into the nine holes marked with small circles.

6. Turn the main chassis front upside down and remove the four BH3 × 6 screws of (8). Lift and remove the LCD unit.


(8) BH3 × 6 screws
(×4)
★
(8)
★
(8)
(8)
LCD unit
(LQ150X1LW72)
Main chassis front

When reassembling, fix the screws indicated with stars first.

When reassembling, peel off the protective sheet and tighten the screws.

(Rear side)
Do not remove the tape fixing the cables.

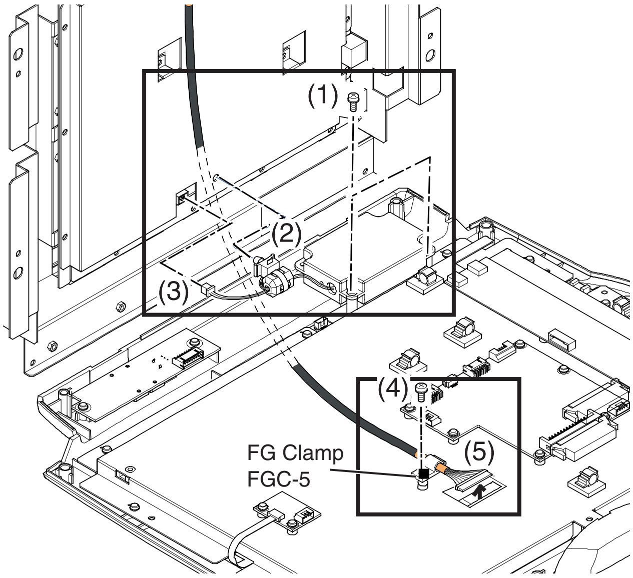
Pass the cable through the opening.

Replacing the Touch Screen

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 6 of “Removing the FRONT IF Board (UR-3956)”.

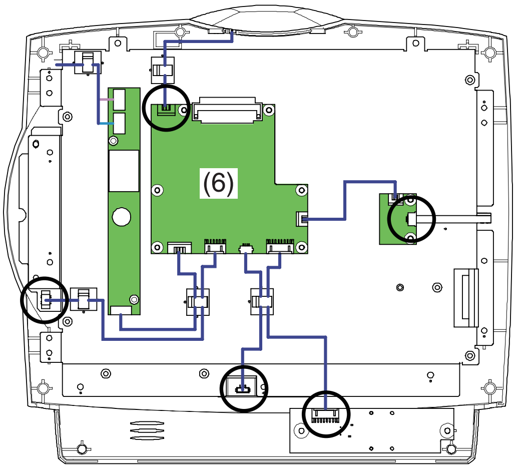
2. Remove the two BH3 × 6 screws of (1). Remove the ferrite core fixture of (2) and connector (3), and then remove the speaker.

3. Remove the BH3 × 6 screw of (4) that fixes the FG clamp. Then remove the cable connector of (5) from the LCD unit.

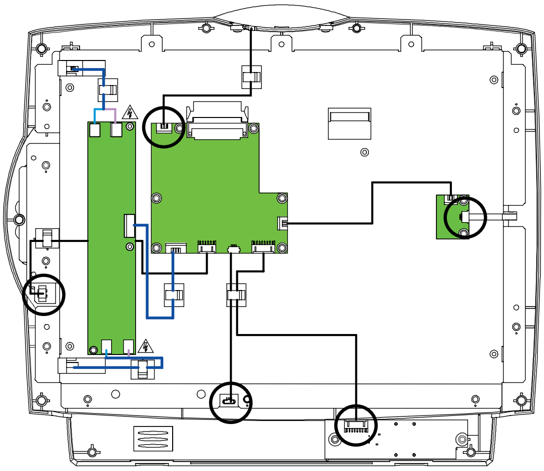


4. Remove the five cables shown below.

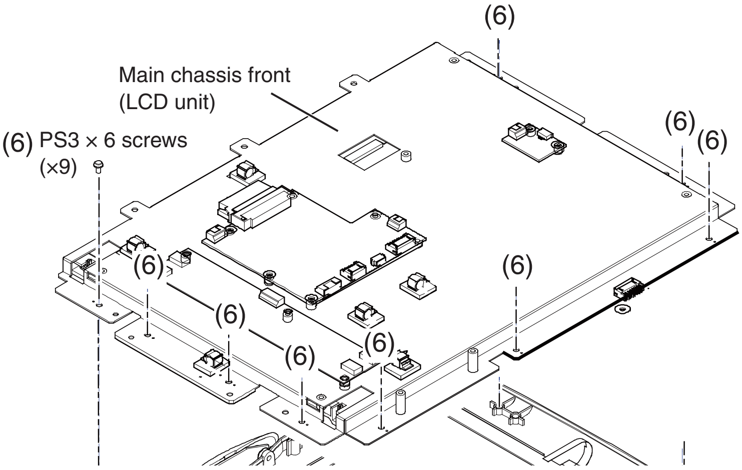
MU-651R



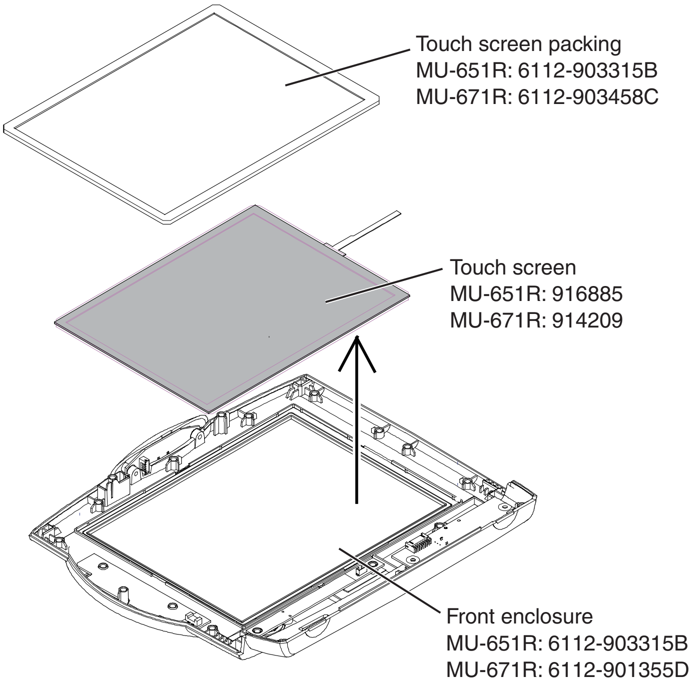
MU-671R



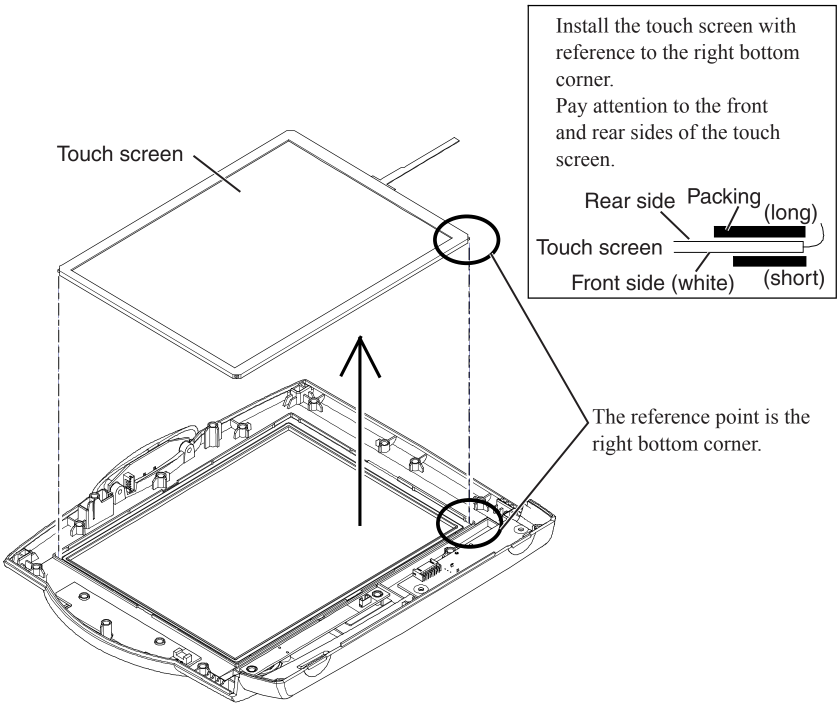
5. Remove the nine PS3 × 6 screws of (6) and remove the main chassis front.


(6)
Main chassis front
(LCD unit)
(6) PS3 × 6 screws
(×9)
(6)
(6)
(6)
(6)
(6)
(6)
(6)
(6)

6. Remove the touch screen from the front enclosure and the touch screen packing from the touch screen.


Touch screen packing
MU-651R: 6112-903315B
MU-671R: 6112-903458C
Touch screen
MU-651R: 916885
MU-671R: 914209
Front enclosure
MU-651R: 6112-903315B
MU-671R: 6112-901355D

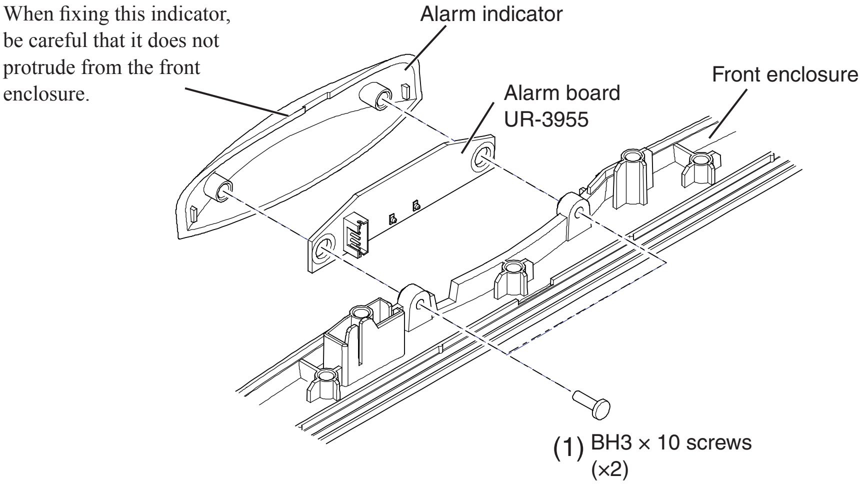
7. When installing, place the touch panel with its rear side up, pass the cable of the touch screen through the packing, and attach the packing to the touch screen. Set the touch screen into the front enclosure with its front side up and with reference to the right bottom corner.


Install the touch screen with reference to the right bottom corner.
Pay attention to the front and rear sides of the touch screen.
Rear side
Packing
(long)
Touch screen
Front side (white)
(short)
Touch screen
The reference point is the right bottom corner.

Removing the ALARM Board (UR-3955)

1. Remove the rear enclosure and separate the front and rear sections. Then remove the LCD together with the main chassis. For details, refer to steps 1 to 4 of “Replacing the Touch Screen”.

2. Remove the alarm indicator from the front enclosure. Remove the two BH3 × 10 screws of (1) and remove the alarm board (UR-3955).

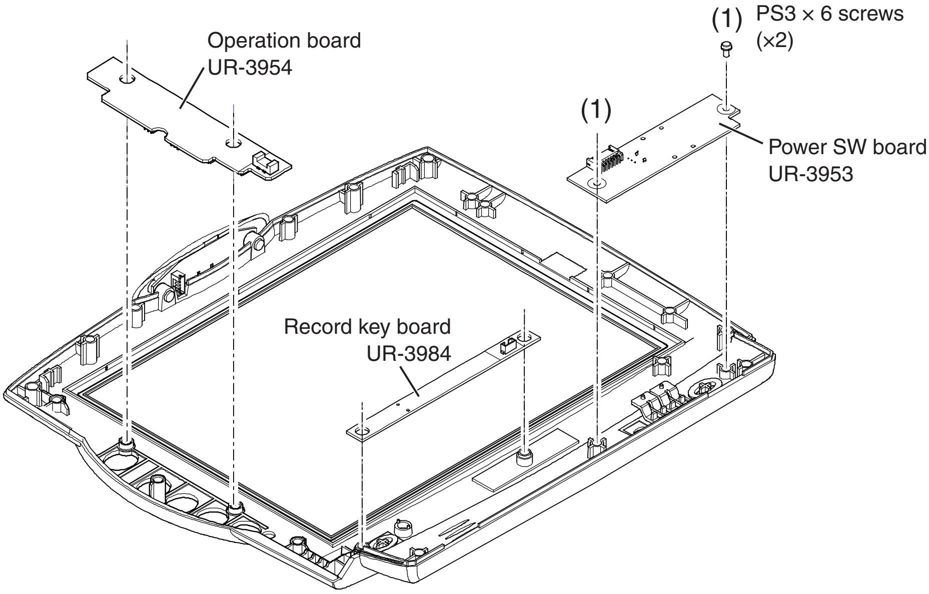

When fixing this indicator, be careful that it does not protrude from the front enclosure.
Alarm indicator
Alarm board
UR-3955
Front enclosure
(1) BH3 × 10 screws
(×2)

Removing the Operation Board, Record Key Board and Power SW Board (UR-3954/3984 /3953)

1. Remove the rear enclosure and separate the front and rear sections. Then remove the LCD together with the main chassis. For details, refer to steps 1 to 4 of “Replacing the Touch Screen”.

2. Remove the five PS3 × 6 screws and two PSW × 6 screws. Then remove the LCD together with the main chassis from the front enclosure. For details, refer to “Removing the Touch Screen”.

3. Remove the two PS3 × 6 screws of (1) and power SW board (UR-3953). Remove the record key board (UR-3984) and operation board (UR-3954) which are mounted on protrusions of the front enclosure.

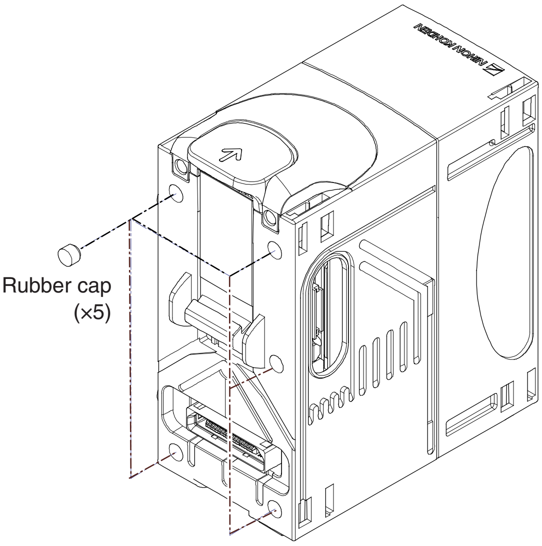

(1) PS3 × 6 screws (×2)
Operation board UR-3954
(1)
Power SW board UR-3953
Record key board UR-3984

Disassembling the Input Unit (AY-631P/633P/651P/653P/660P/661P/663P/671P/673P)

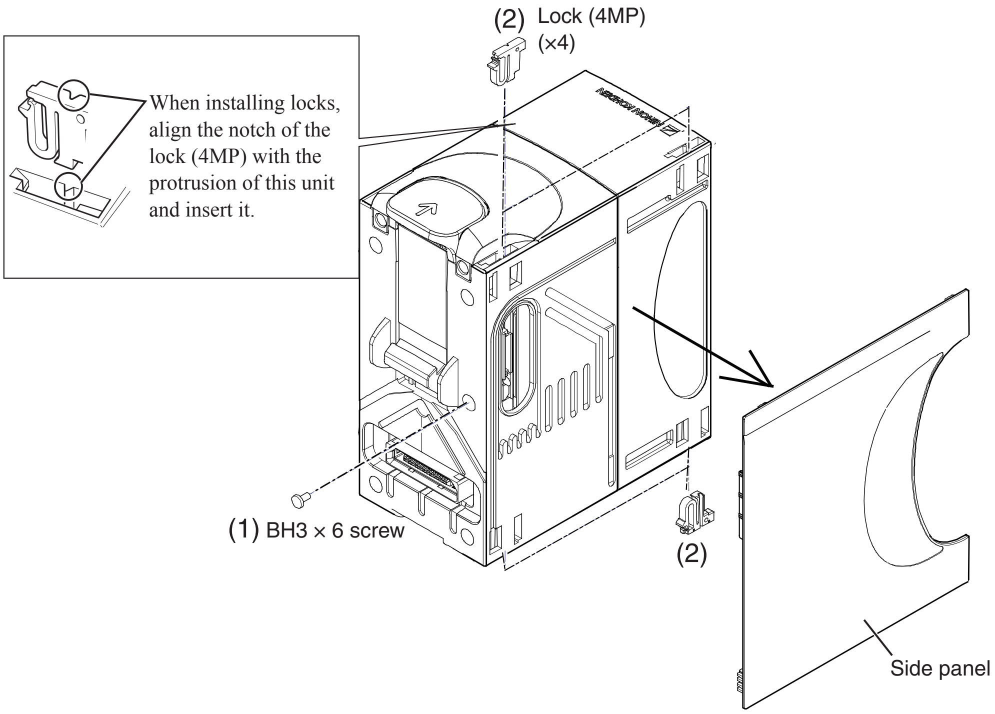
Tools required: A Phillips-head screwdriver (for M3 and M4), a Phillips-head screwdriver (M2), a flathead screwdriver, a flathead screwdriver (1.4 mm), a box screwdriver (AY-660P/661P/663P/671P/673P: 5.5 mm, AY-631P/633P/651P/653P: 5 mm) and tweezers

Removing the Front Enclosure

1. Remove the five rubber caps from the rear side of the input unit.



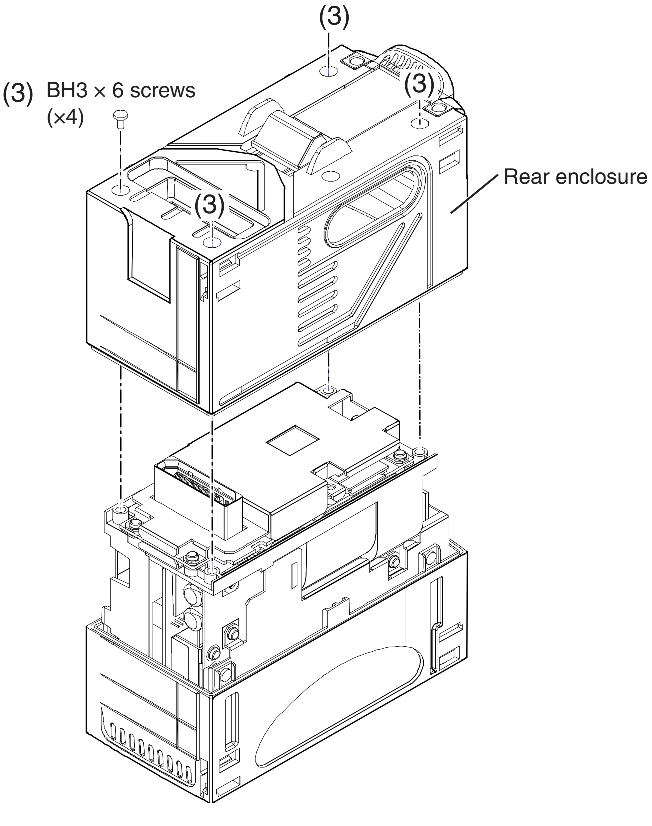
2. Remove the BH3 × 6 screw of (1). Use the flathead screwdriver (1.4 mm) to remove the two locks of (2) from both the top and bottom of the input unit. Then remove the side panel.



When installing locks, align the notch of the lock (4MP) with the protrusion of this unit and insert it.

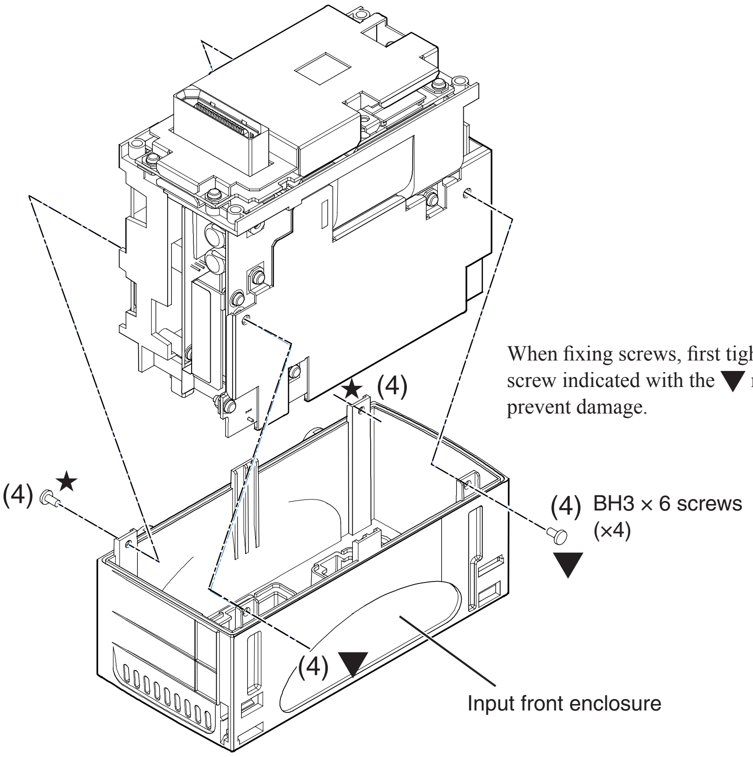
(2) Lock (4MP)
(×4)
(1) BH3 × 6 screw
(2)
Side panel

3. Remove the four BH3 × 6 screws of (3) and rear enclosure.



(3)
(3) BH3 × 6 screws
(×4)
(3)
(3)
Rear enclosure

4. Remove the four BH3 × 6 screws of (4) and front enclosure. Remove the screws indicated with stars first.

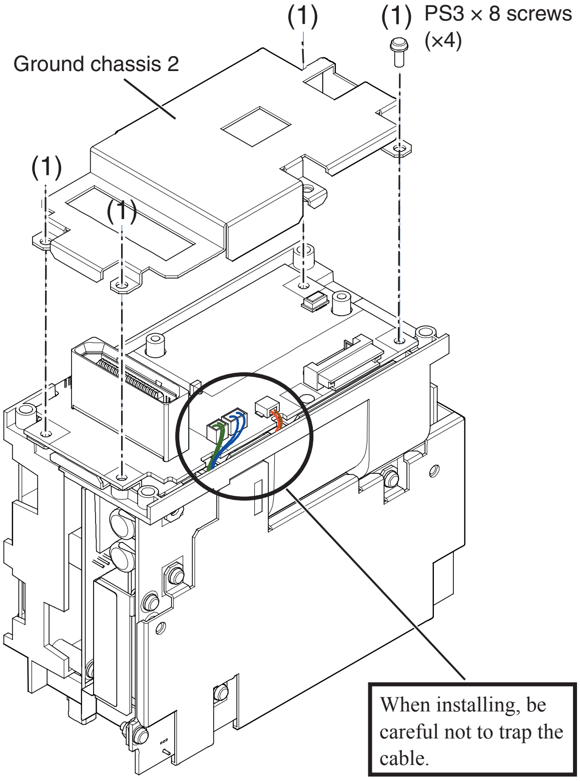

(4) ★
★ (4)
(4) BH3 × 6 screws (×4)
▼
(4) ▼
Input front enclosure

When fixing screws, first tighten the screw indicated with the ▼ mark to prevent damage.

Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)

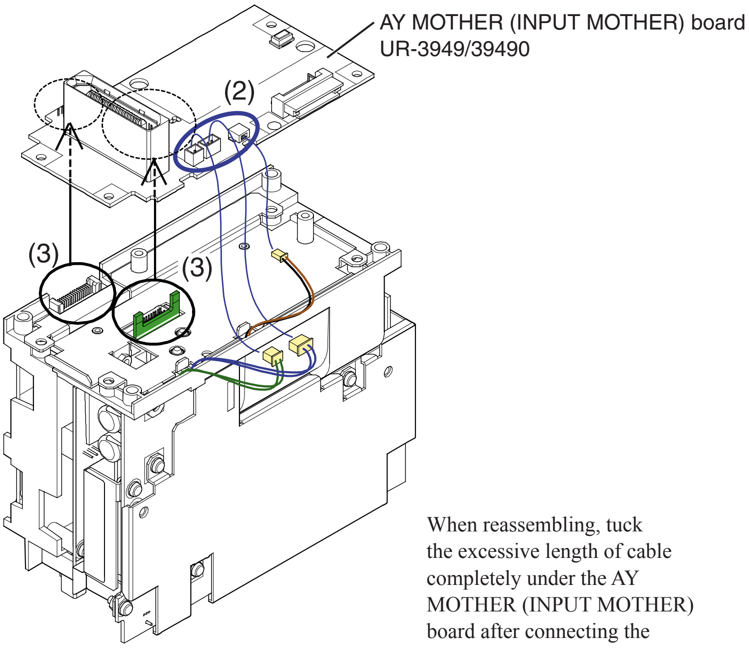
1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.

2. Remove the four PS3 × 8 screws of (1) and ground chassis 2 from the rear side.


(1)
(1) PS3 × 8 screws (×4)
Ground chassis 2
(1)
(1)

When installing, be careful not to trap the cable.

3. Remove the connectors of (2) connecting the cables to the pump and the solenoid valve. Lift the AY MOTHER (INPUT MOTHER) board, remove the two connectors of (3) connected on the rear side of the board, and remove the AY MOTHER (INPUT MOTHER) board.


AY MOTHER (INPUT MOTHER) board
UR-3949/39490
(2)
(3)
(3)

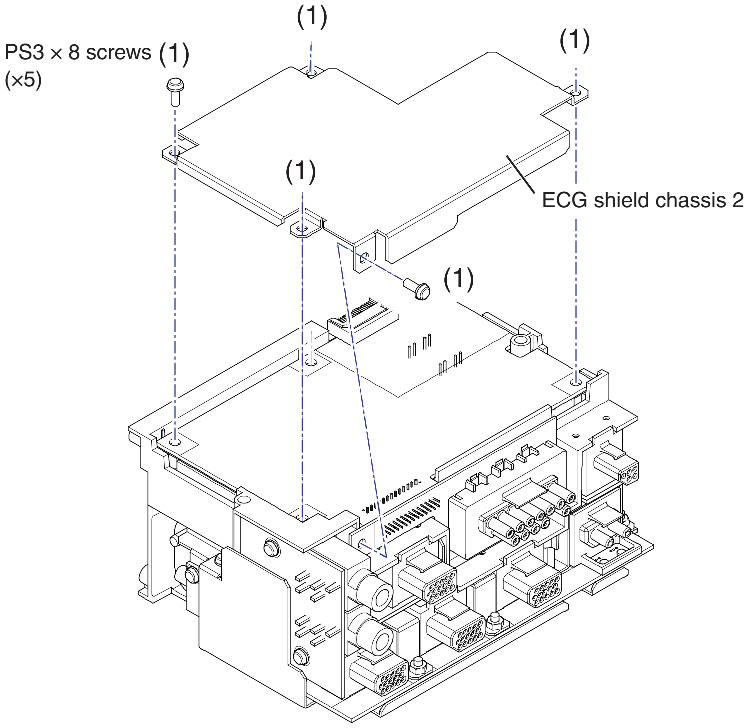
When reassembling, tuck the excessive length of cable completely under the AY MOTHER (INPUT MOTHER) board after connecting the connectors.

Removing the ECG RESP Board (UR-3951/39510)

1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.

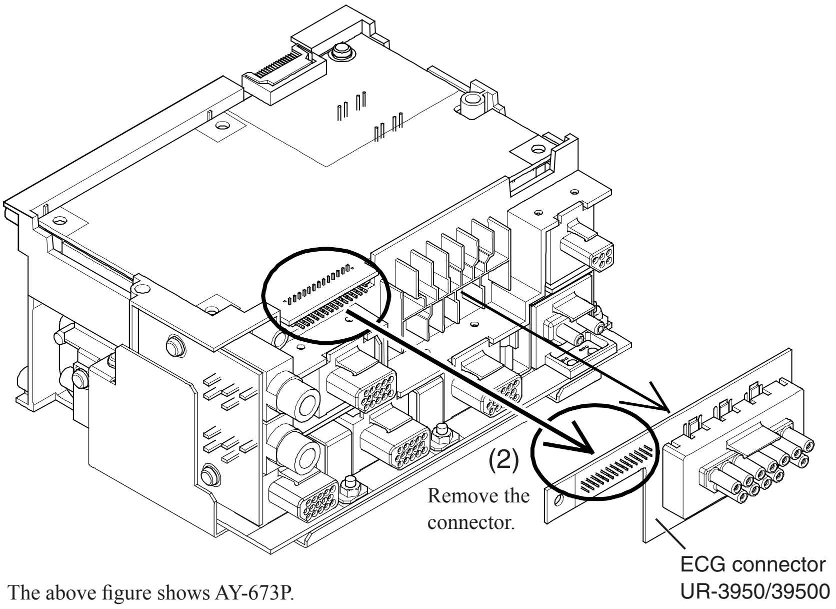
2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.

3. Remove the five PS3 × 8 screws of (1) and ECG shield chassis 2.


(1)
(1)
PS3 × 8 screws (1)
(×5)
(1)
ECG shield chassis 2
(1)

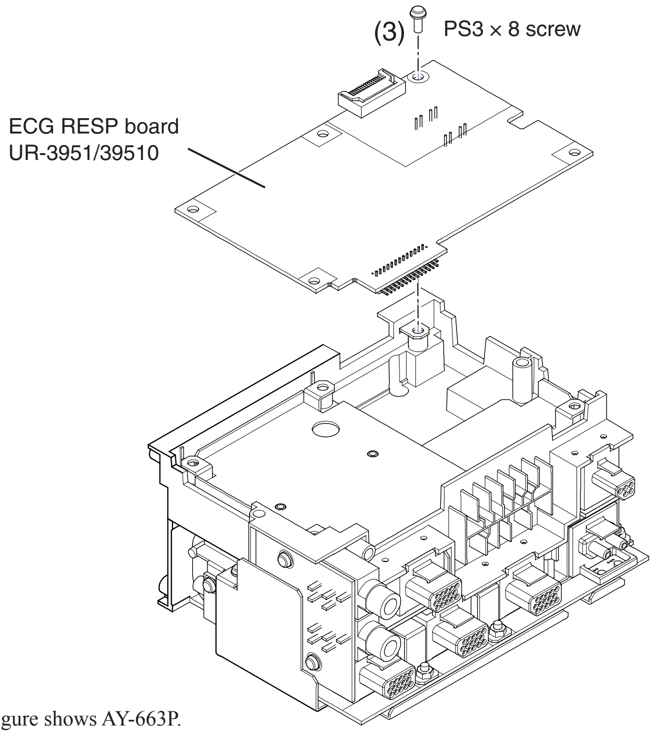
The above figure shows AY-663P.

4. Remove the ECG connector (UR-3950/39500) that is directly connected to the connector of (2).


(2)
Remove the connector.
ECG connector
UR-3950/39500

The above figure shows AY-673P.

5. Remove the PS3 × 8 screw of (3) and ECG RESP board.



The above figure shows AY-663P.

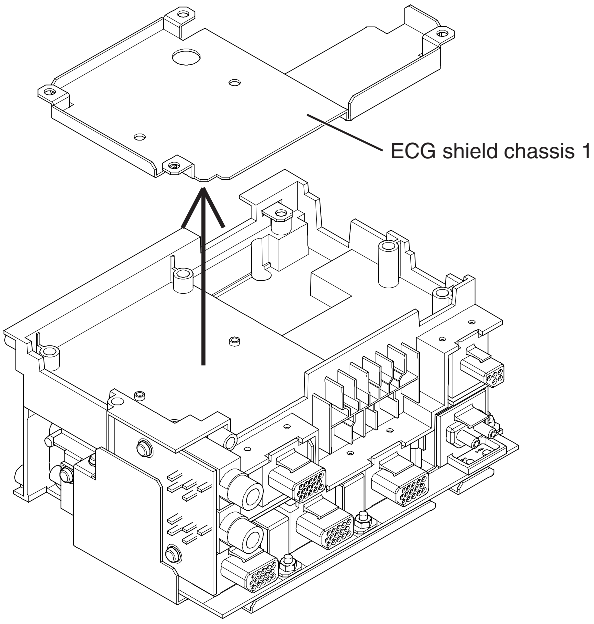
Removing the NIBP Unit (SG-670P/671P/673P)

1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.

2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.

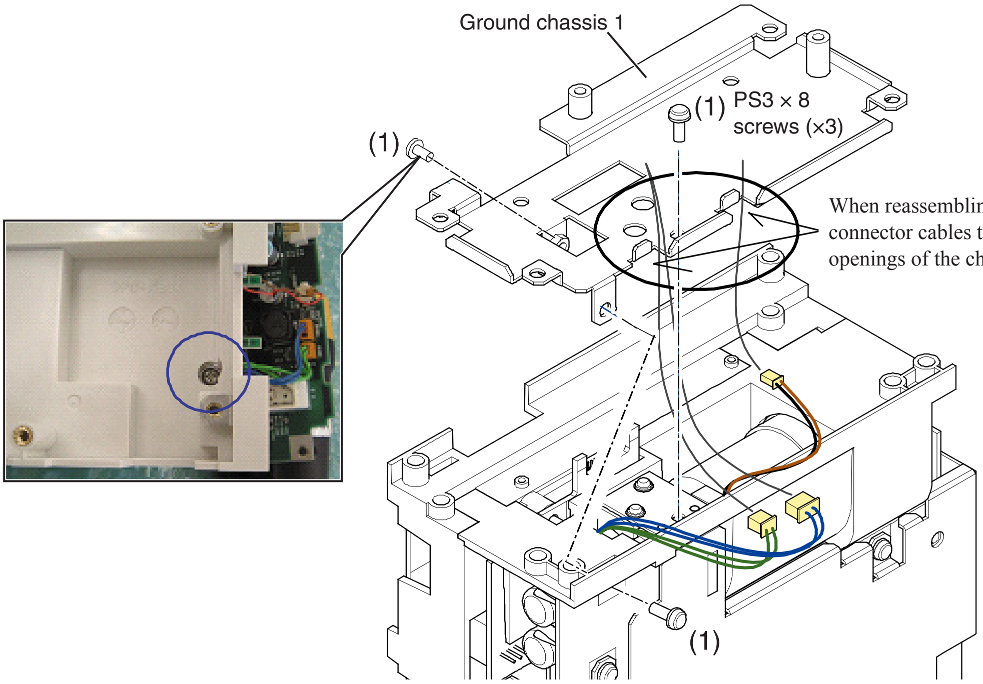
3. Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.

4. Lift and remove the ECG shield chassis 1.


ECG shield chassis 1

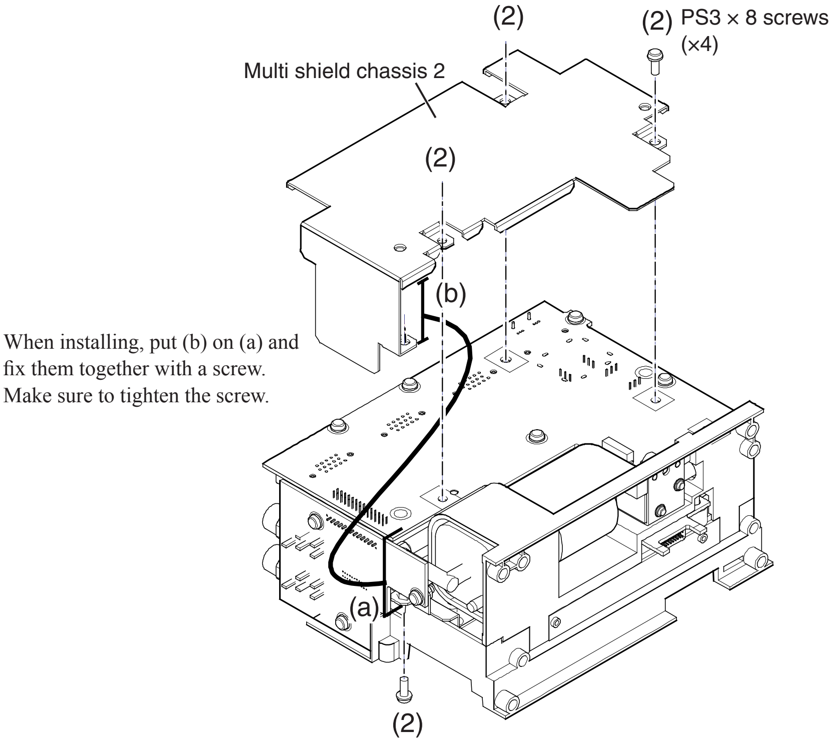
The above figure shows AY-663P.

5. Remove three PS3 × 8 screws of (1). Then lift and remove the ground chassis 1.


Ground chassis 1
(1) PS3 × 8
screws (×3)
(1)
(1)

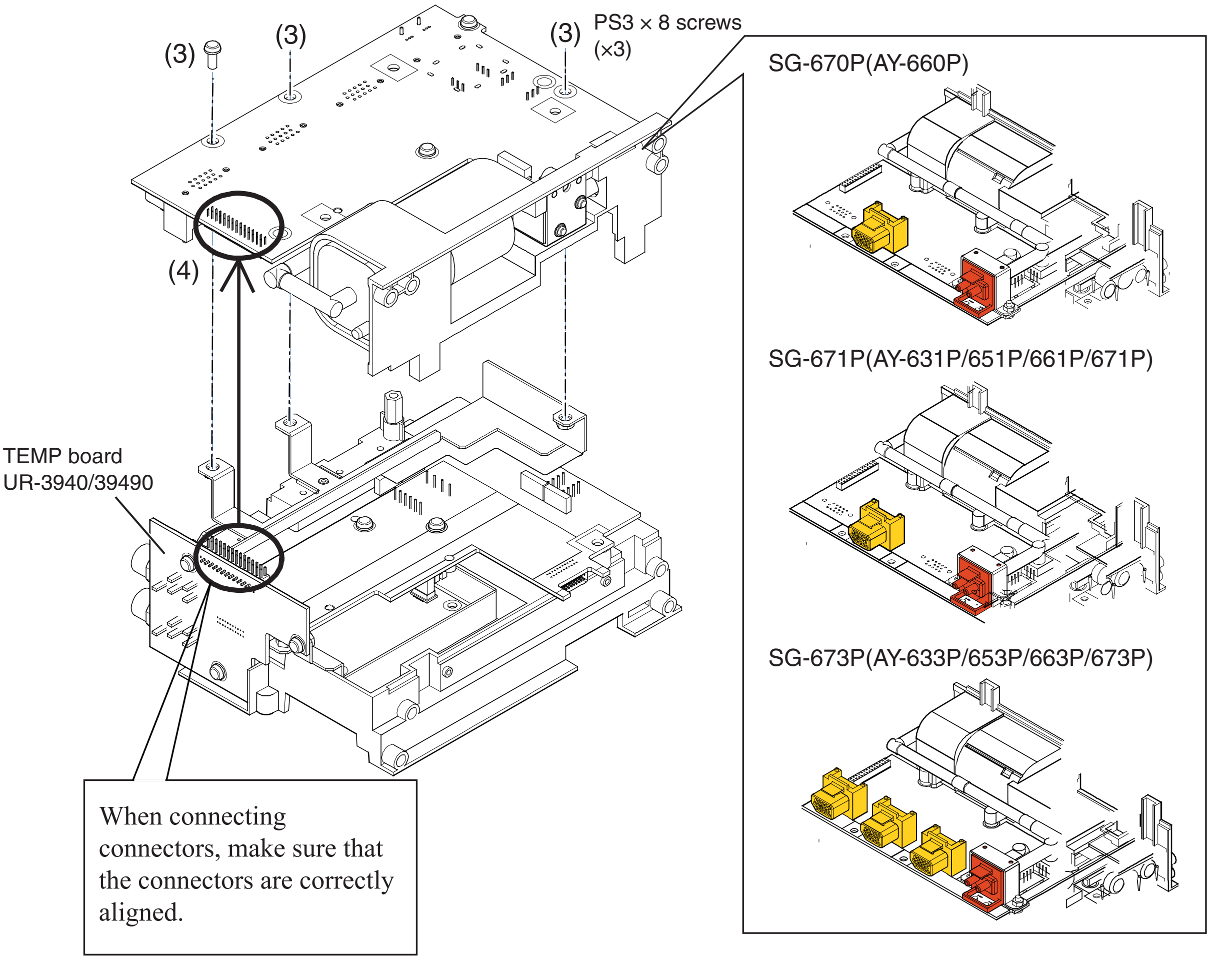
When reassembling, pass the connector cables through the openings of the chassis.

6. Remove the four PS3 × 8 screws of (2). Then lift and remove the multi shield chassis 2.


(2)
(2) PS3 × 8 screws (×4)
Multi shield chassis 2
(2)
(b)
(a)
(2)

When installing, put (b) on (a) and fix them together with a screw. Make sure to tighten the screw.

7. Remove the three PS3 × 8 screws of (3). Remove the connector of (4) that is connected to the connector of TEMP board (UR-3940/39490) and remove the NIBP unit (SG-670P/671P/673P).


(3)
(3)
(3) PS3 × 8 screws (×3)
(4)
TEMP board UR-3940/39490
SG-670P(AY-660P)
SG-671P(AY-631P/651P/661P/671P)
SG-673P(AY-633P/653P/663P/673P)

When connecting connectors, make sure that the connectors are correctly aligned.

Removing the SpO$_2$ Board

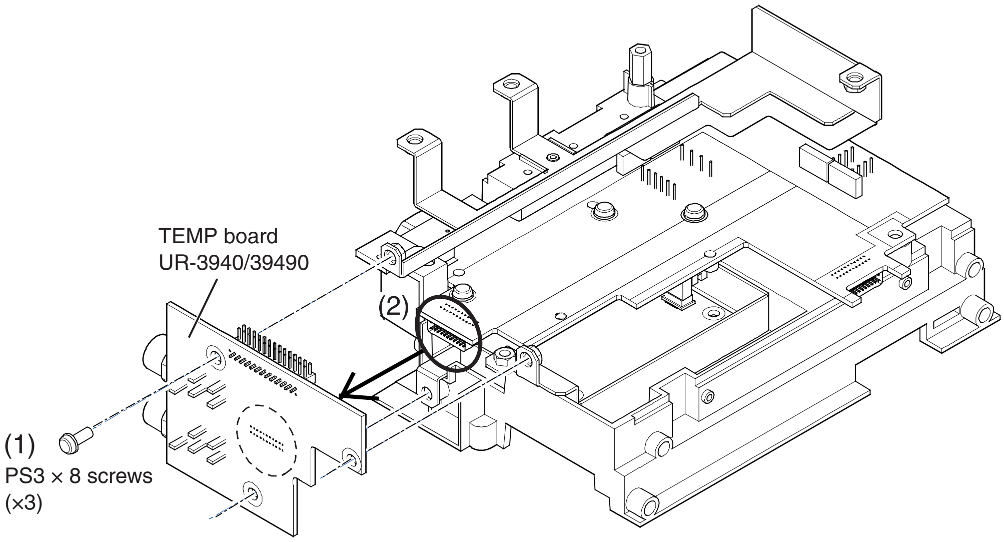
1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.

2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.

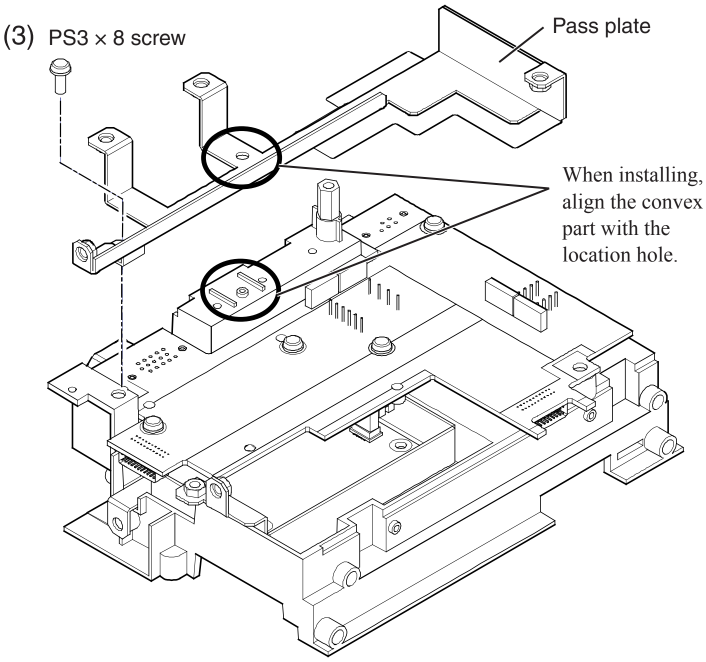
3. Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.

4. Remove the SG-670P/671P/673P. For details, refer to “Removing the NIBP Unit (SG-670P/671P/673P)”.

5. Remove the three PS3 × 8 screws of (1) and connector of (2). Then remove the TEMP board (UR-3940/39400) from MPU PWR board.

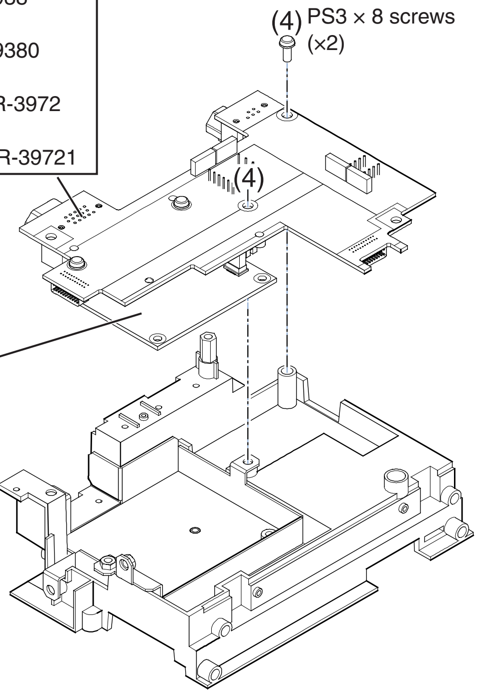

TEMP board
UR-3940/39490
(2)
(1)
PS3 × 8 screws
(×3)

6. Remove the PS3 × 8 screw of (3) and pass plate (steel plate).


(3) PS3 × 8 screw
Pass plate
When installing,
align the convex
part with the
location hole.

7. Remove the two PS3 × 8 screws of (4) and MPU PWR board (UR-3938/3972/39380/39721).

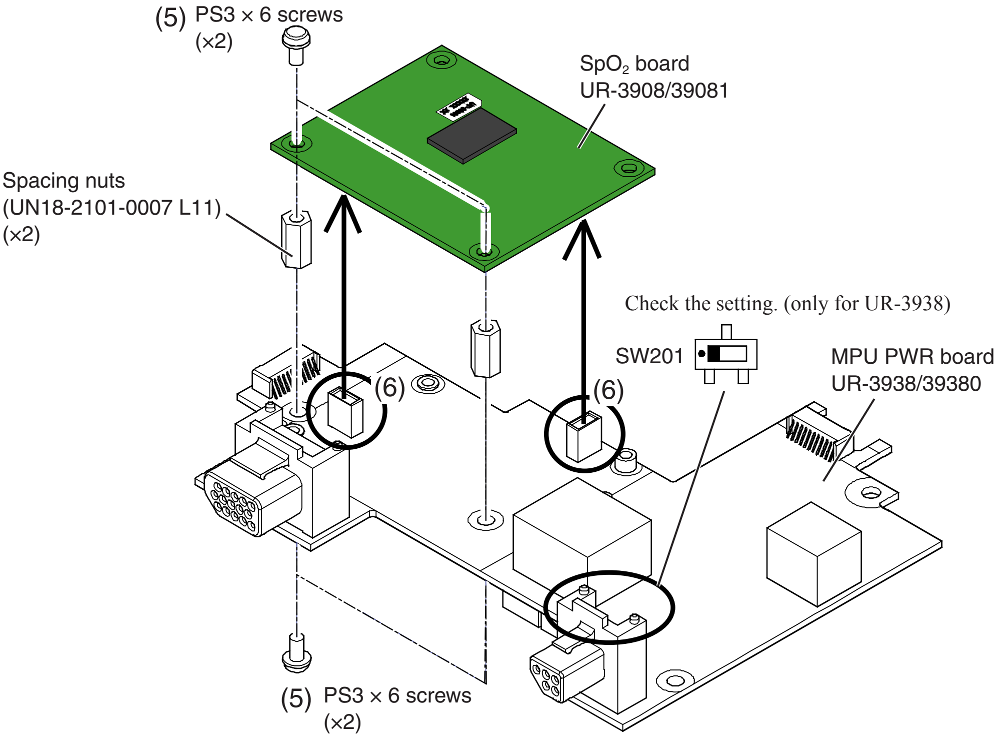
AY-661P/663P/671P/673P (NK)
MPU PWR board: UR-3938
AY-660P (NK)
MPU PWR board: UR-39380
AY-651P/653P (Nellcor)
MPU PWR board NL: UR-3972
AY-631P/633P (Masimo)
MPU PWR board MS: UR-39721


(4) PS3 × 8 screws
(×2)
(4)

AY-671P/673P (NK)
SpO_2 board: UR-39081
AY-660P/661P/663P (NK)
SpO_2 board: UR-3908
AY-651P/653P (Nellcor)
NELL 1 OXIMAX PULSEOXIMETRY MOD: 719697
AY-631P/633P(Masimo)
MS-13 board: 911765

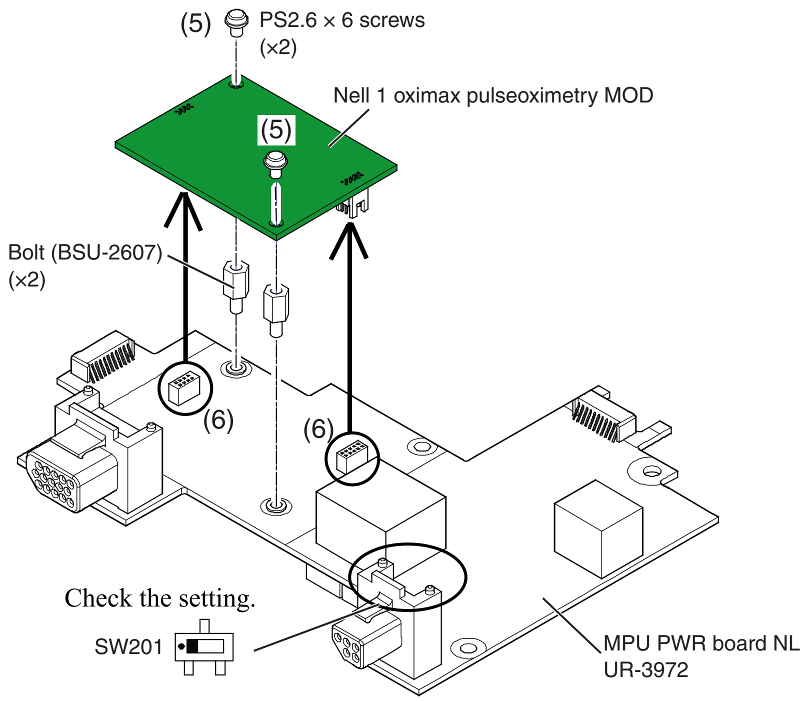
8. Remove the two screws of (5). The screw sizes are different between NK and other makers. Remove the two connectors of (6) that are directly connected to the MPU PWR board. The connector location varies depending on the SpO_2 type. Then remove the SpO_2 board from the MPU PWR board.

AY-660P/661P/663P/AY-671P/673P (NK SpO_2) [two PS3 × 6 screws]

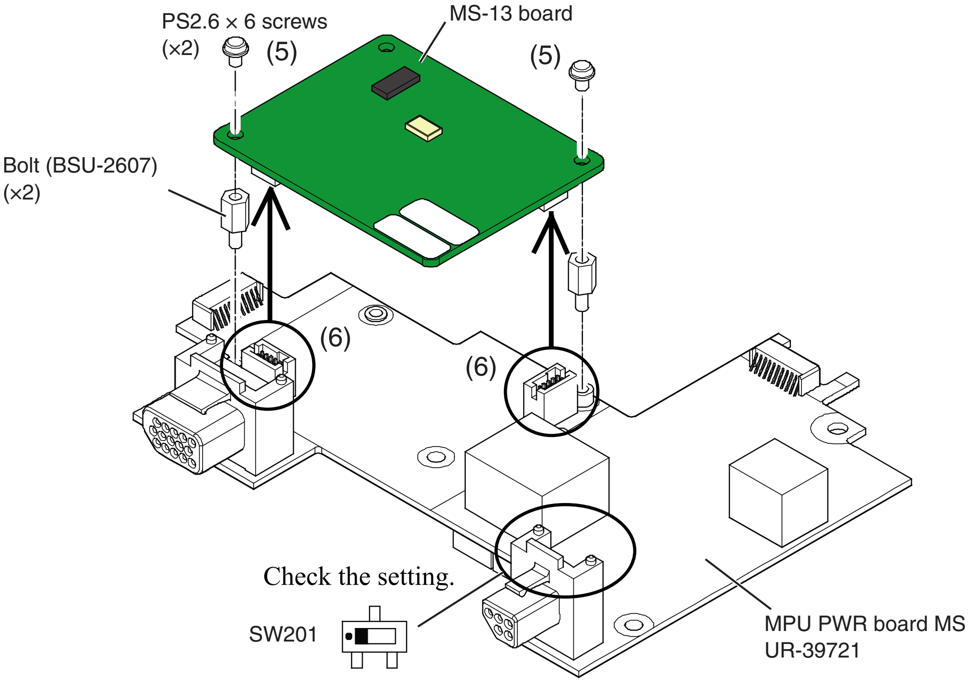

(5) PS3 × 6 screws
(×2)
SpO_2 board
UR-3908/39081
Spacing nuts
(UN18-2101-0007 L11)
(×2)
SW201
(6)
(6)
MPU PWR board
UR-3938/39380
(5) PS3 × 6 screws
(×2)

Check the setting. (only for UR-3938)

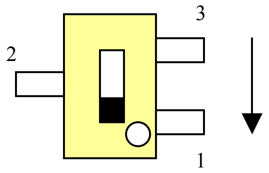
AY-651P/653P (Nellcor SpO$_2$) [two PS2.6 × 6 screws]


(5)
PS2.6 × 6 screws
(×2)
Nell 1 oximax pulseoximetry MOD
(5)
Bolt (BSU-2607)
(×2)
(6)
(6)
Check the setting.
SW201
MPU PWR board NL
UR-3972

AY-631P/633P (Masimo SpO$_2$) [two PS2.6 × 6 screws]


PS2.6 × 6 screws
(×2)
(5)
MS-13 board
(5)
Bolt (BSU-2607)
(×2)
(6)
(6)
Check the setting.
SW201
MPU PWR board MS
UR-39721

Dip Switch (SW201) Settings



When the MPU PWR board is replaced with a new one, check that the terminal 1 of SW201 switch on the new board is selected.

Disassembling the NIBP Unit (SG-670P/671P/673P)

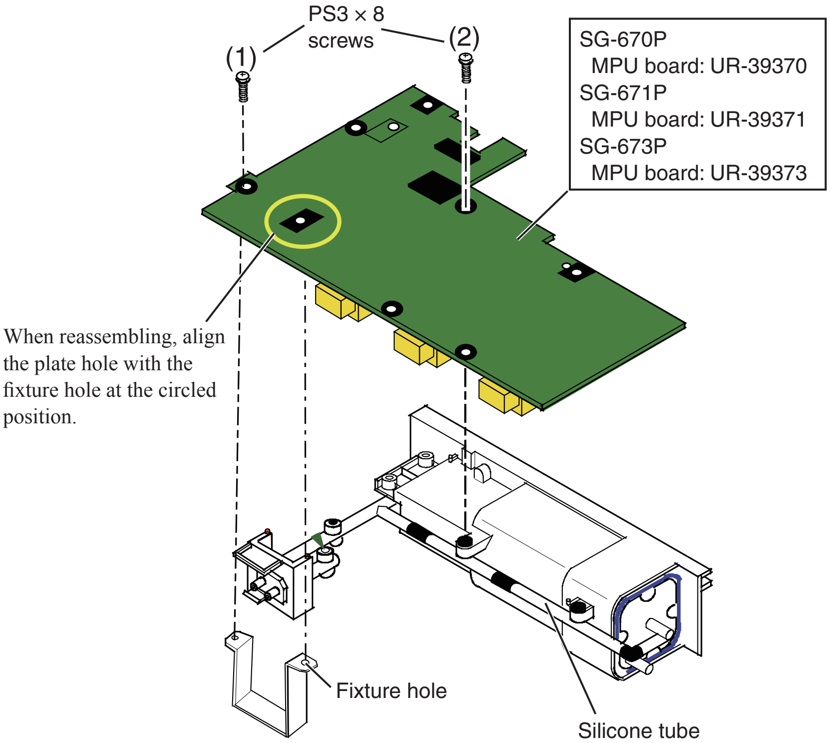
1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.

2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.

3. Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.

4. Remove the SG-670P/671P/673P. For details, refer to “Removing the NIBP Unit (SG-670P/671P/673P)”.

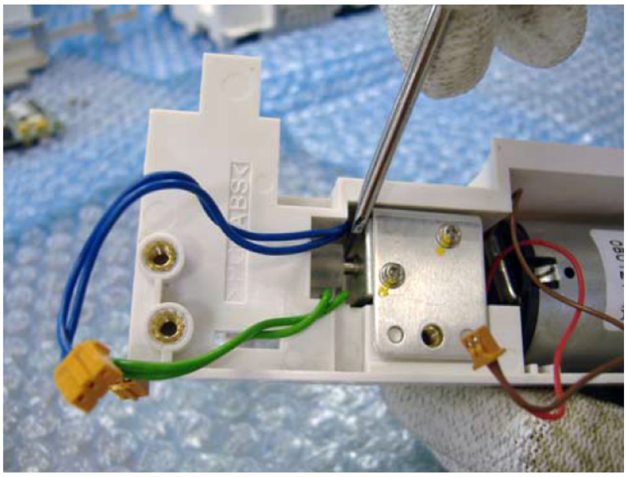
5. Remove the PS3 × 8 screw of (1) and remove the plate holding down the NIBP connector. Remove the PS3 × 8 screw of (2) and silicone tube from the MPU board (UR-39370/39371/39373).

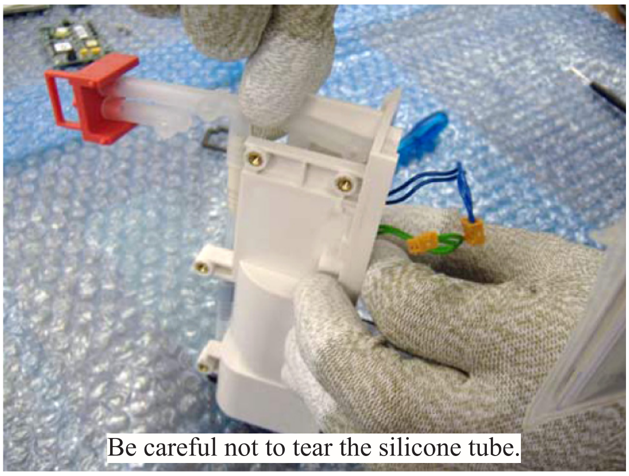


SG-670P
MPU board: UR-39370
SG-671P
MPU board: UR-39371
SG-673P
MPU board: UR-39373

When reassembling, align the plate hole with the fixture hole at the circled position.

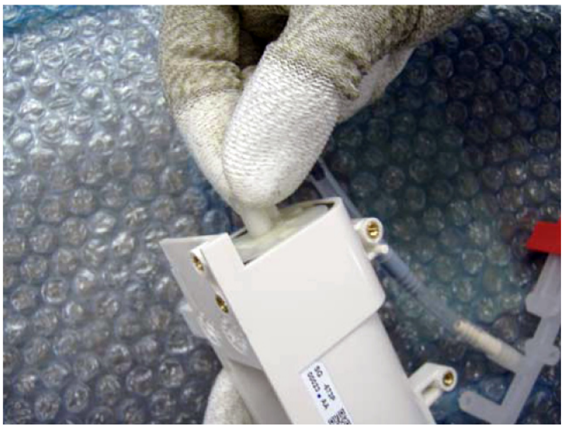
6. Remove the silicone tube from the solenoid valve.





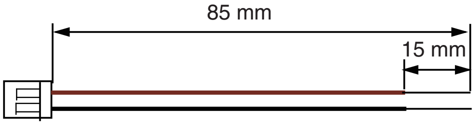
Be careful not to tear the silicone tube.

7. Remove the silicone tube from the pump and push the pump out.



Notes on Rolling Pump Replacement

1. Processing and installing the rolling pump P22D/CNA
   - i) Cut the wires of the CNA cable (IL-Z-2S-S125C3) to the length of 85 mm and strip the wire insulation about 15 mm from the end.

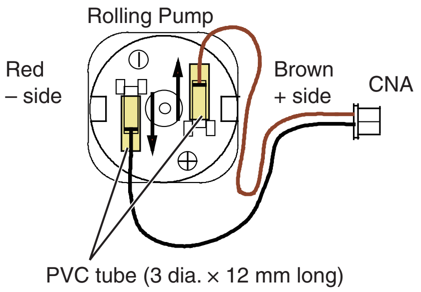


   - ii) Connect the brown wire of the CNA cable to the plus (+) side of the rolling pump and the red wire of the CNA cable to the minus (–) side of the rolling pump.
   - iii) Insert each of the CNA wires (red and brown) into each PVC tube (3 dia. × 12 mm long). Solder the wires to the fixture slits of the rolling pump and cover the connected positions with PVC tubes.

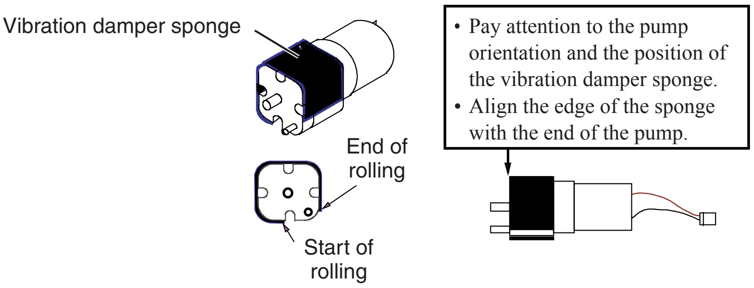
NOTE

The PVC tube should be inserted to the end of the pump fixture.

   - iv) Fold the minus and plus side terminals in the directions of the arrows shown below from their base.


Rolling Pump
Red
– side
Brown
+ side
CNA
PVC tube (3 dia. × 12 mm long)

2. Attaching vibration damper sponge

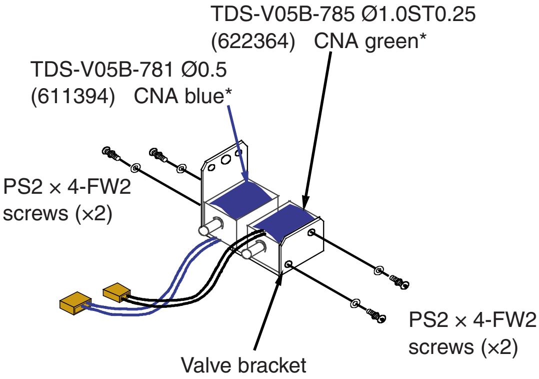

Vibration damper sponge
End of
rolling
Start of
rolling

- Pay attention to the pump orientation and the position of the vibration damper sponge.
- Align the edge of the sponge with the end of the pump.

Notes on Installing the Valve on the Valve Bracket

3. Installing the valve into the valve bracket

   Fix the valve on the valve bracket with the four PS2 × 4-FW2 screws.

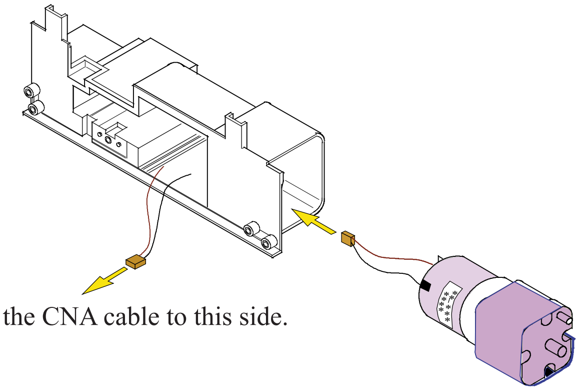

TDS-V05B-785 Ø1.0ST0.25
(622364) CNA green*
TDS-V05B-781 Ø0.5
(611394) CNA blue*
PS2 × 4-FW2
screws (×2)
PS2 × 4-FW2
screws (×2)
Valve bracket

*Be careful not to fix the blue and green cables in reverse.

Notes on Installing the Rolling Pump and NIBP FRAME

Installing the Rolling Pump/NIBP FRAME M

- Pay attention to the orientation of the rolling pump.
- Hold the vibration damper sponge with fingers to prevent it from peeling off while inserting the rolling pump into NIBP FRAME M.
- After installation, pull out the CNA cable from NIBP FRAME M.

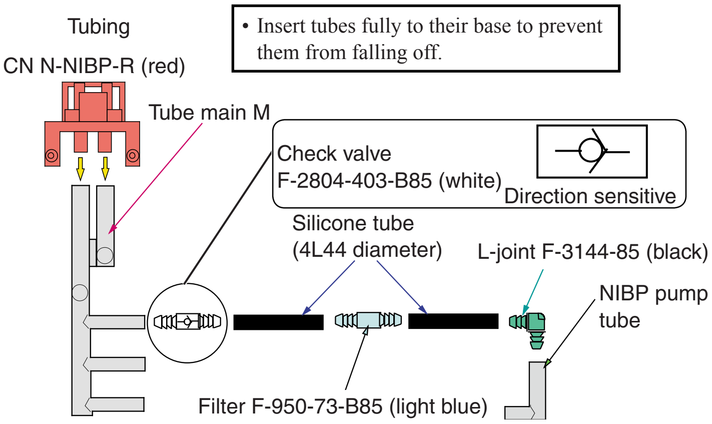


Pull out the CNA cable to this side.

Note on Installing Tubes

Connecting Tubing to the Board

- Insert tubes fully to their base to prevent them from falling off.

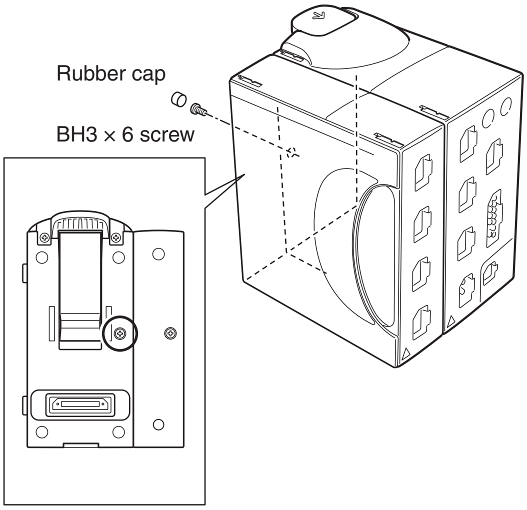

Tubing
CN N-NIBP-R (red)
Tube main M
Check valve
F-2804-403-B85 (white)
Direction sensitive
Silicone tube
(4L44 diameter)
L-joint F-3144-85 (black)
NIBP pump
tube
Filter F-950-73-B85 (light blue)

Disassembling the Smart Expansion Unit (AA-672P/674P)

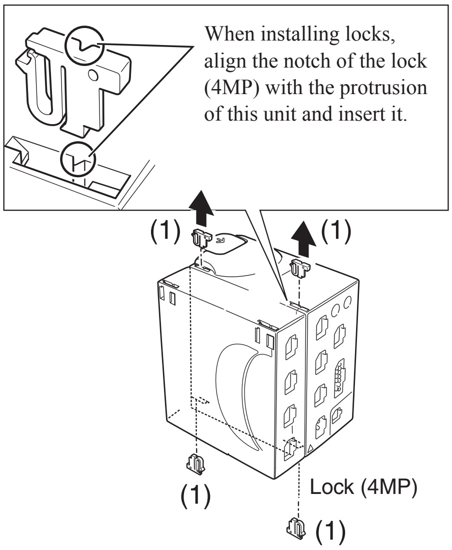
Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, a flathead screwdriver (1.4 mm) and tweezers

Removing the Smart Expansion Unit from the Input Unit

1. Use the flathead screwdriver (1.4 mm) to remove the rubber cap and BH3 × 6 screw from the rear panel of the input unit.

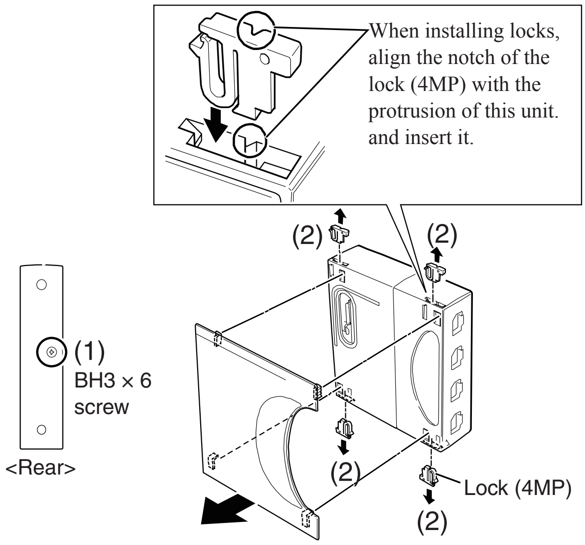

Rubber cap
BH3 × 6 screw

2. Use the flathead screwdriver (1.4 mm) to hold down the stoppers of the four locks of (1) and remove the locks (two from the top and another two from the bottom). Then separate the input unit and the smart expansion unit.

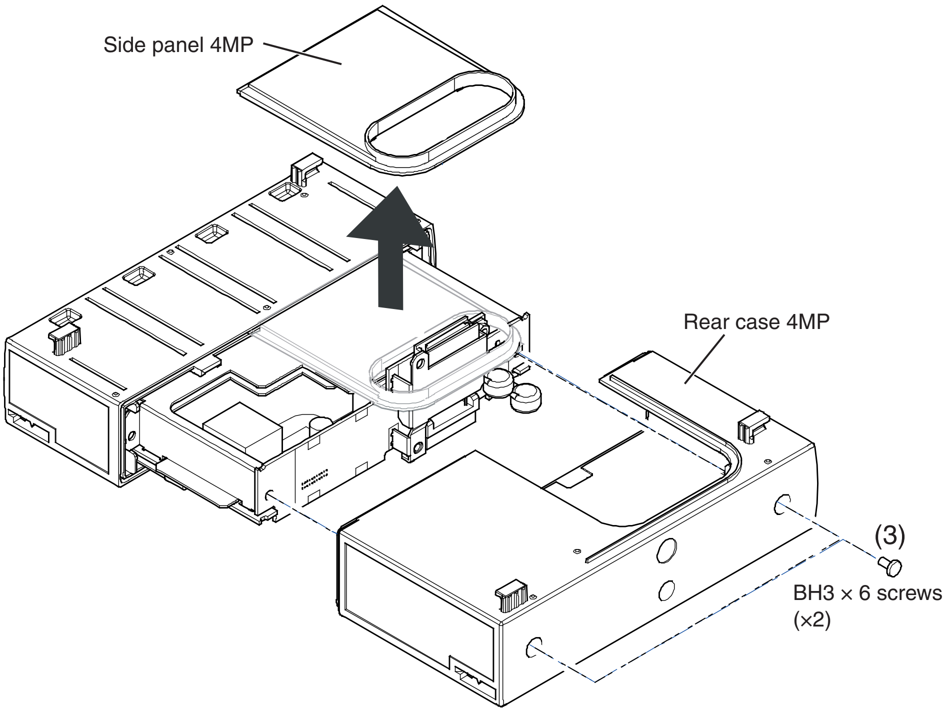

When installing locks, align the notch of the lock (4MP) with the protrusion of this unit and insert it.
(1)
(1)
(1)
Lock (4MP)
(1)

Disassembling the Smart Expansion Unit

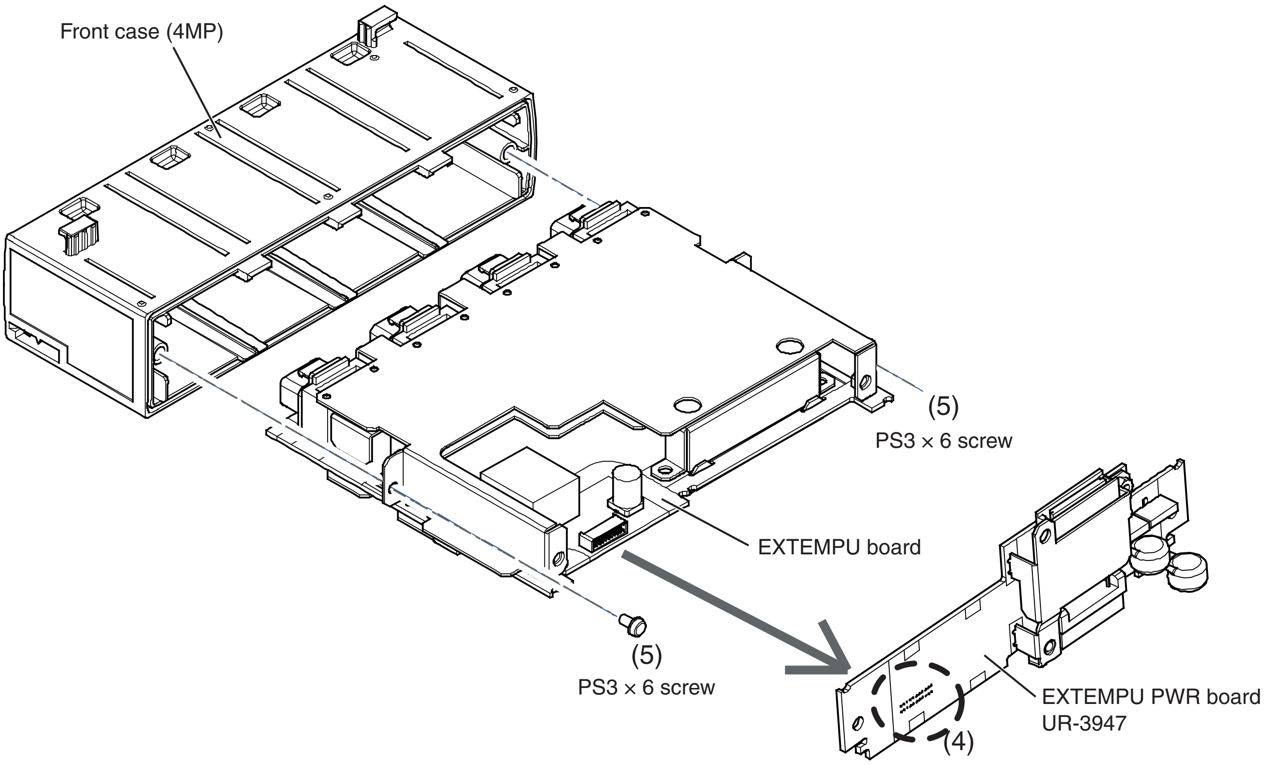
1. Remove the BH3 × 6 screw of (1) from the rear side of the unit. Use the flathead screwdriver (1.4 mm) to hold down the stoppers of the four locks of (2) and remove the locks (two from the top and another two from the bottom). Then remove the side panel.


When installing locks, align the notch of the lock (4MP) with the protrusion of this unit. and insert it.
(2)
(2)
(1)
BH3 × 6
screw
<Rear>
(2)
Lock (4MP)
(2)

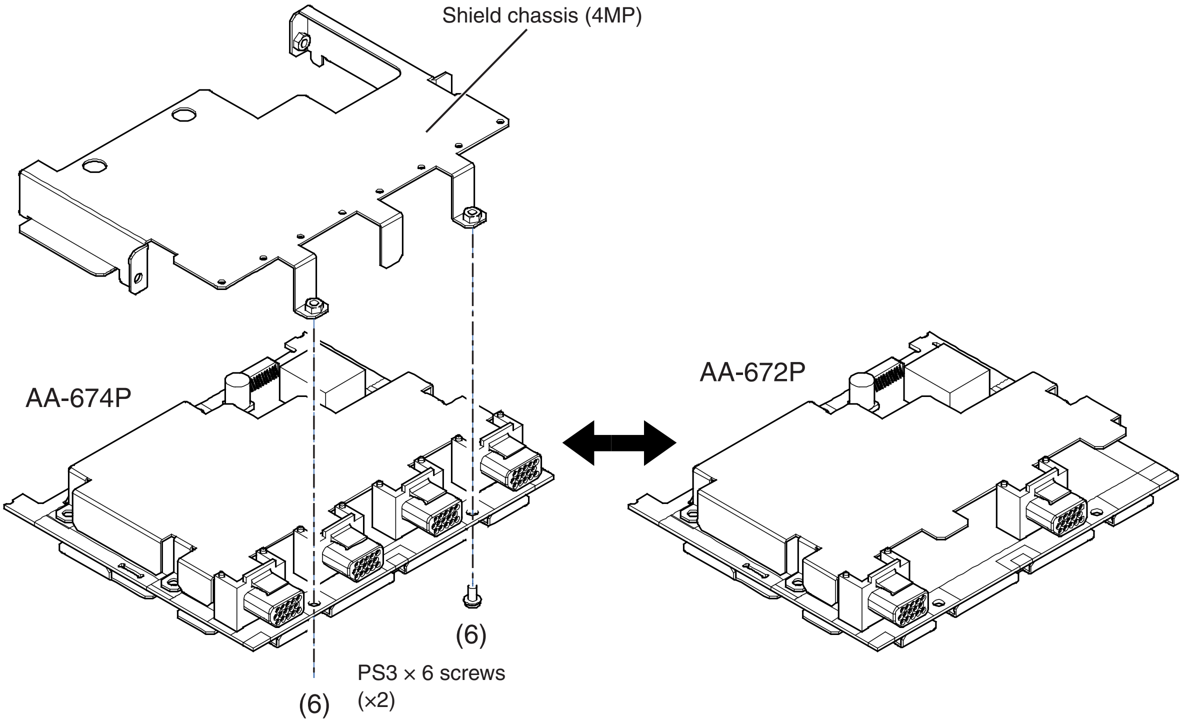
2. Use the Phillips-head screwdriver to remove the two BH3 × 6 screws of (3). Remove the rear case and the side panel 4MP.


Side panel 4MP
Rear case 4MP
(3)
BH3 × 6 screws
(×2)

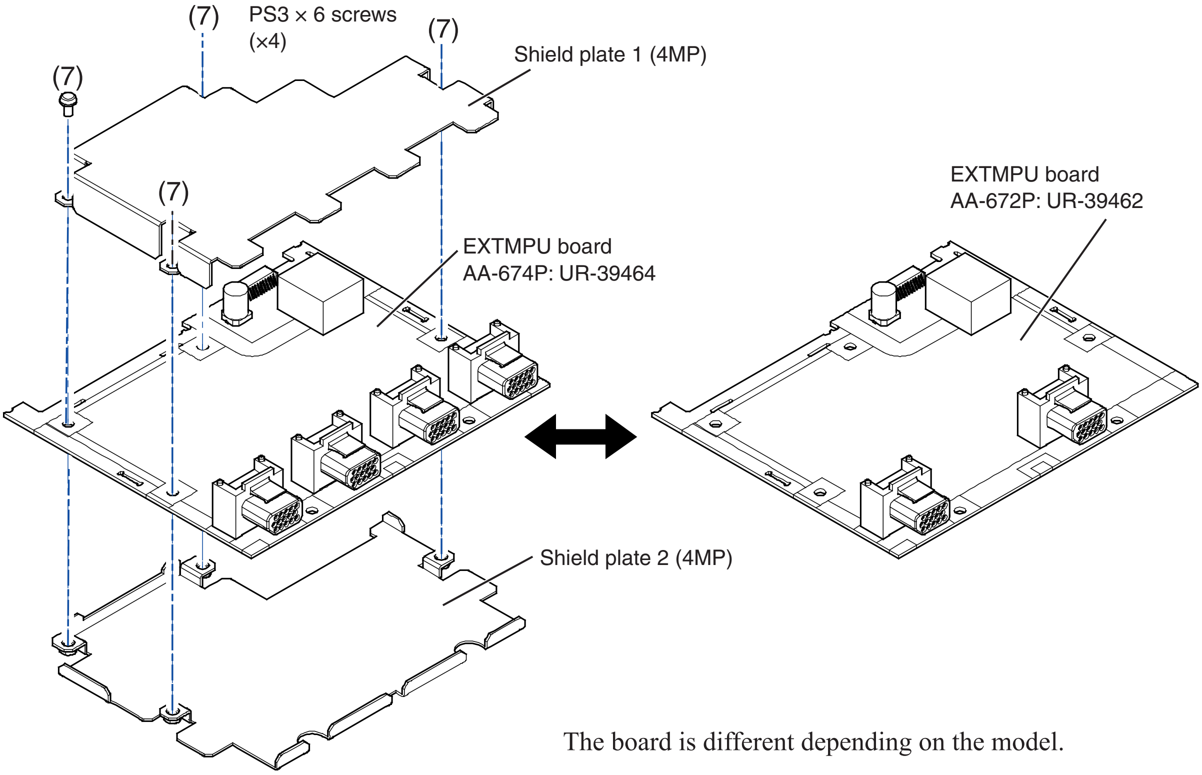
3. Remove the connector of (4) that is directly connected to the EXTEMPU PWR board. Then remove the EXTMPU PWR board (UR-3947). Remove the two PS3 × 6 screws of (5) and the front case.


Front case (4MP)
(5)
PS3 × 6 screw
EXTEMPU board
(5)
PS3 × 6 screw
EXTEMPU PWR board
UR-3947
(4)

4. Remove the two PS3 × 6 screws of (6) and shield chassis.

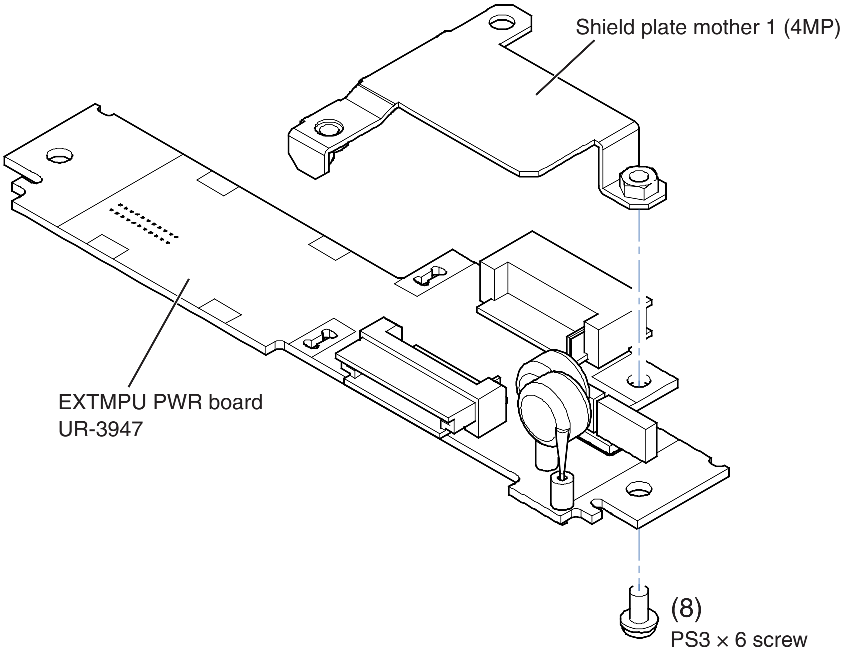

Shield chassis (4MP)
AA-674P
AA-672P
(6)
PS3 × 6 screws
(×2)
(6)

5. Use the Phillips-head screwdriver to remove the four PS3 × 6 screws of (7). Then remove the shield plate 1 and shield plate 2.


(7)
PS3 × 6 screws (×4)
(7)
(7)
(7)
Shield plate 1 (4MP)
EXTMPU board AA-674P: UR-39464
EXTMPU board AA-672P: UR-39462
Shield plate 2 (4MP)

The board is different depending on the model.

6. Remove the PS3 × 6 screw of (8) and remove the shield plate mother 1. Then remove the EXTMPU PWR board (UR-3947).


Shield plate mother 1 (4MP)
EXTMPU PWR board UR-3947
(8)
PS3 × 6 screw

Disassembling the Recorder Module (WS-671P)

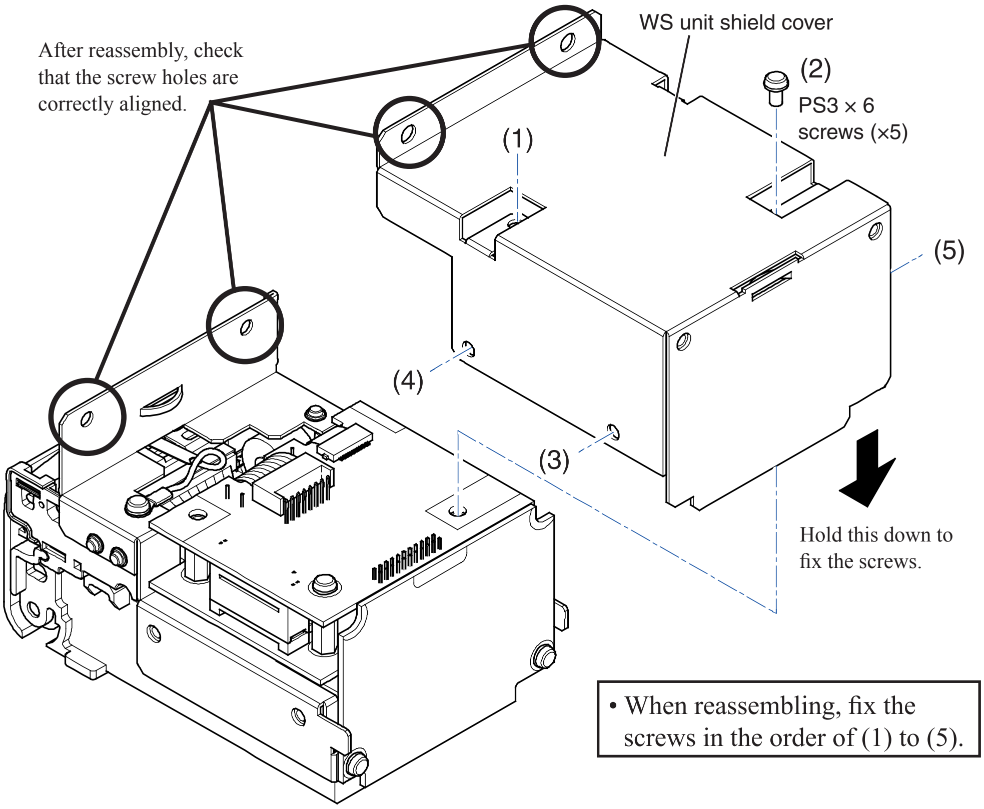
Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, a flathead screwdriver (1.4 mm), a box screwdriver (5.5 mm), and tweezers

Removing the Recorder Module from the Main Unit

When removing the WS-671P recorder module from the MU-631R main unit, refer to the procedure described in “Removing the Recorder Module (WS-671P)” of the “Disassembling the Main Unit (MU-631R)” section. When removing the WS-671P recorder module from the MU-651R or MU-671R main unit, refer to the procedure descried in “Removing the Recorder Module (WS-671P)” of the “Disassembling the Main Unit (MU-651R/671R)” section.

Disassembling the Recorder Module

1. Remove the five PS3 × 6 screws of (1) to (5) and WS unit shield cover.

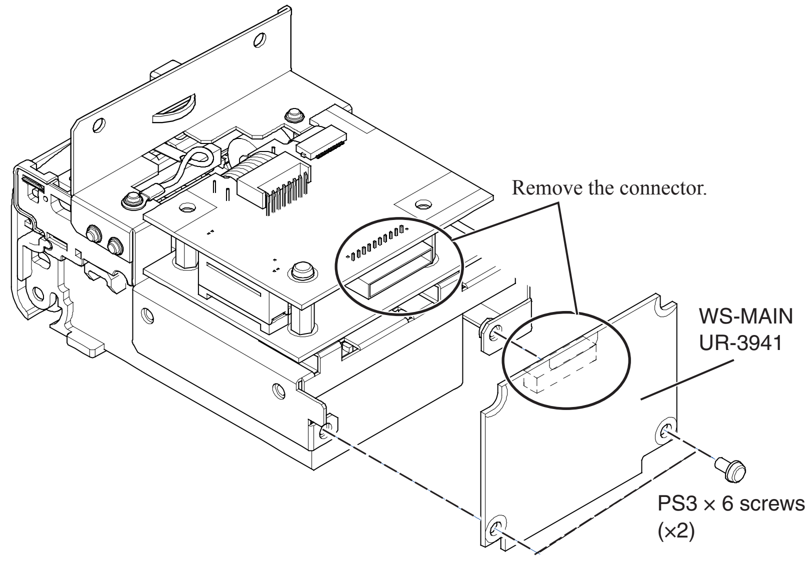


After reassembly, check that the screw holes are correctly aligned.

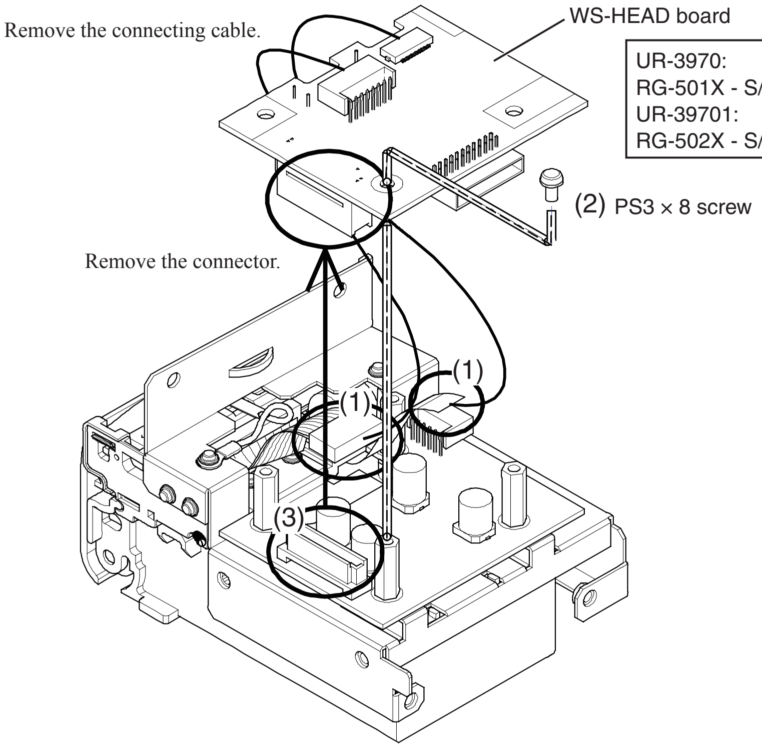
Hold this down to fix the screws.

- When reassembling, fix the screws in the order of (1) to (5).

2. Remove the two PS3 × 6 screws and WS-MAIN (UR-3941).

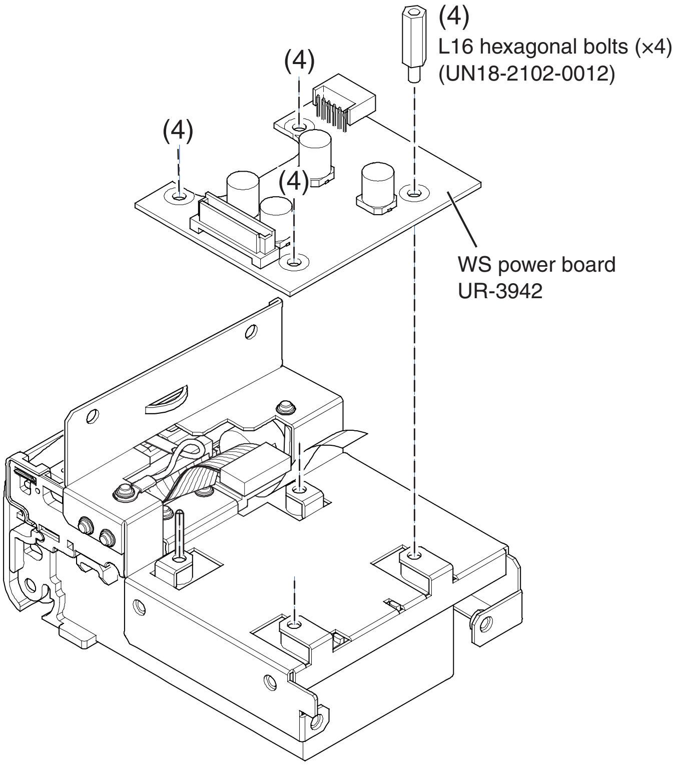

Remove the connector.
WS-MAIN
UR-3941
PS3 × 6 screws
(×2)

3. Remove the two thermal head connectors of (1) and the PS3 × 8 screw of (2). Then remove the connector of (3) that connects the WS power board and WS-HEAD board, and remove the WS-HEAD board (UR-3970/39701).

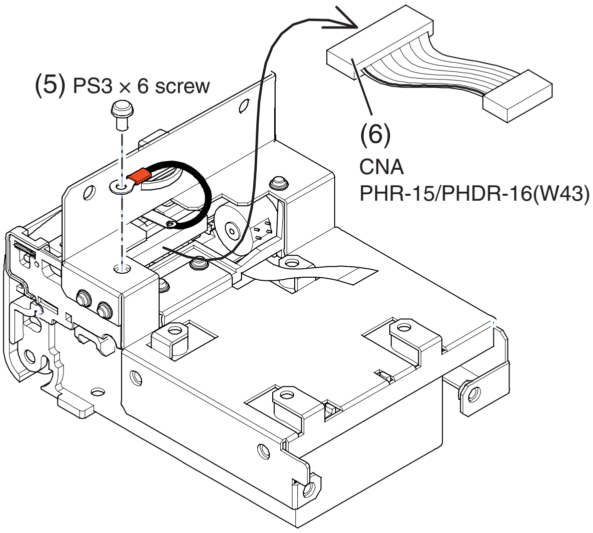

Remove the connecting cable.
WS-HEAD board
(2) PS3 × 8 screw
Remove the connector.
(1)
(1)
(3)

UR-3970:
RG-501X - S/N 01615 (Rev. AA) and earlier
UR-39701:
RG-502X - S/N 01616 (Rev. BA) and later

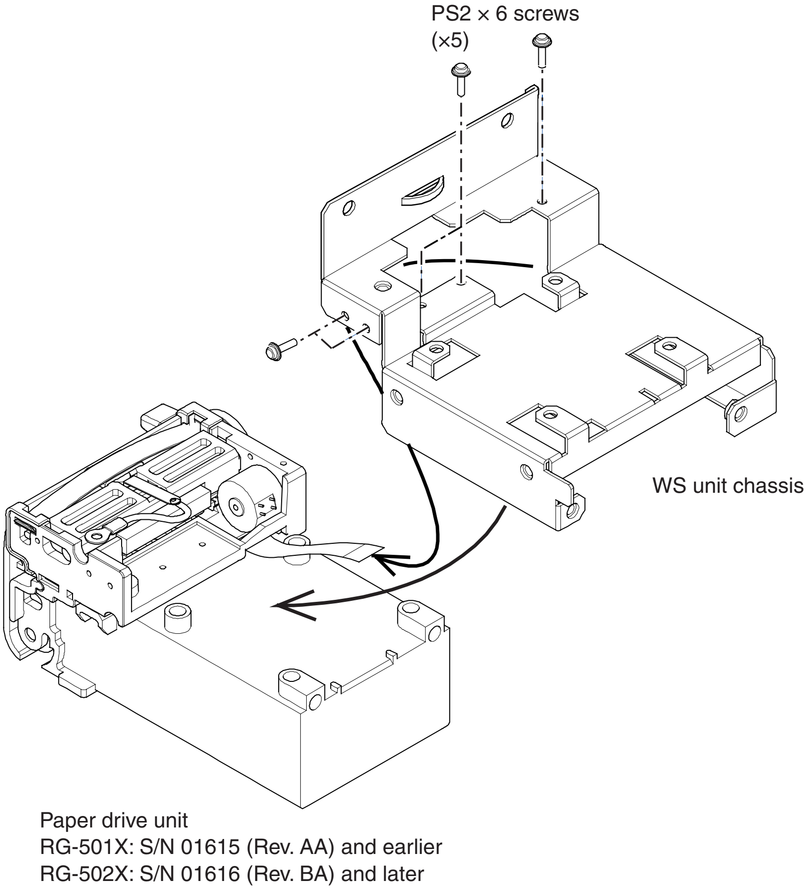
4. Remove the four L16 hexagonal bolts of (4) and WS power board (UR-3942).


(4)
L16 hexagonal bolts (×4)
(UN18-2102-0012)
(4)
(4)
(4)
WS power board
UR-3942

5. Remove the PS3 × 6 screw of (5) and CNA cable of (6).

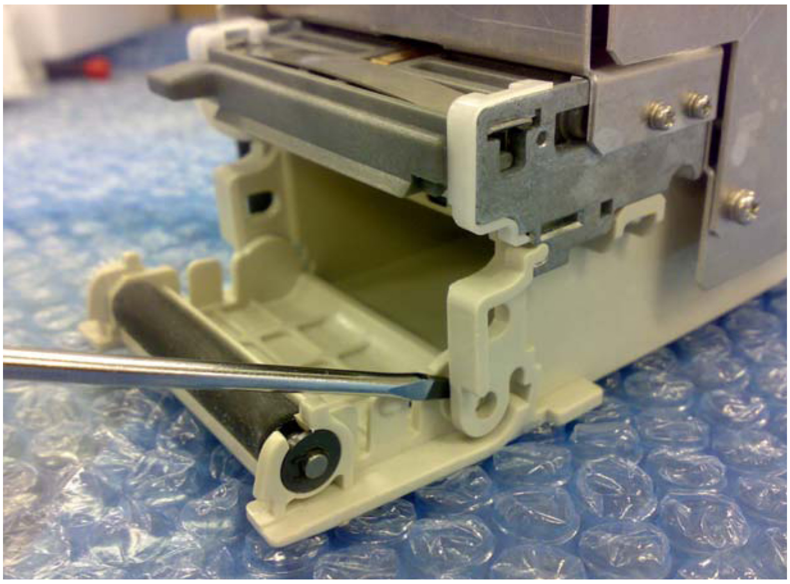

(5) PS3 × 6 screw
(6)
CNA
PHR-15/PHDR-16(W43)

6. Remove the five PS2 × 6 screws and WS unit chassis. Then remove the paper drive unit (RG-501X/502X).

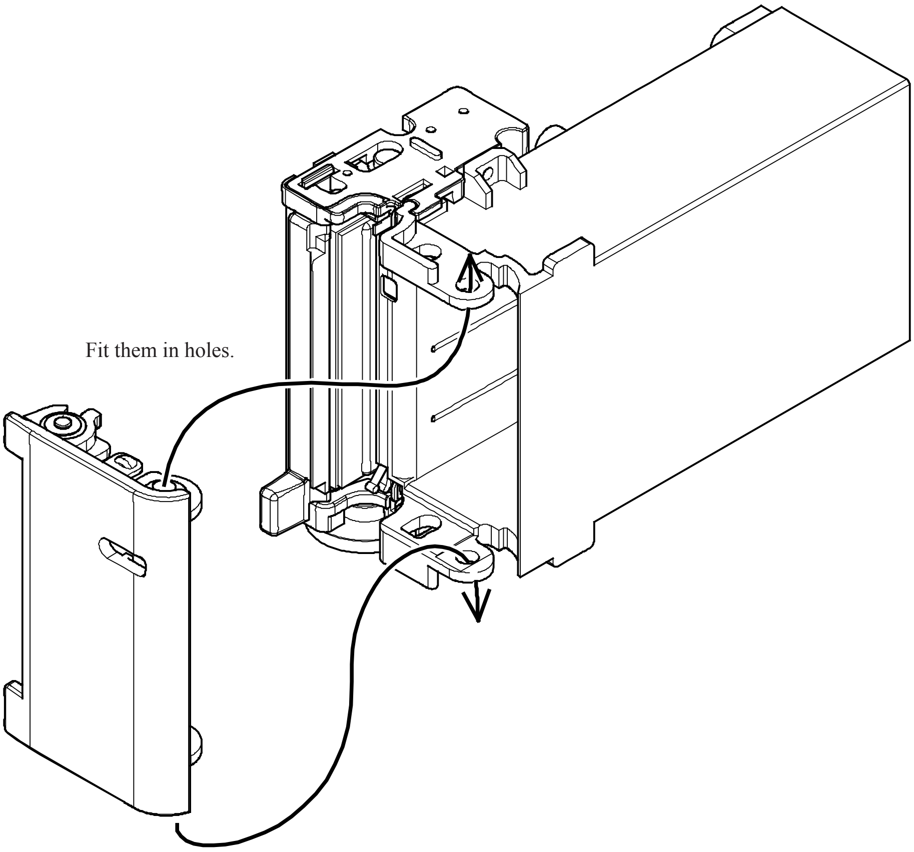

PS2 × 6 screws
(×5)
WS unit chassis
Paper drive unit
RG-501X: S/N 01615 (Rev. AA) and earlier
RG-502X: S/N 01616 (Rev. BA) and later

Disassembling the Paper Drive Unit (RG-501X/502X)

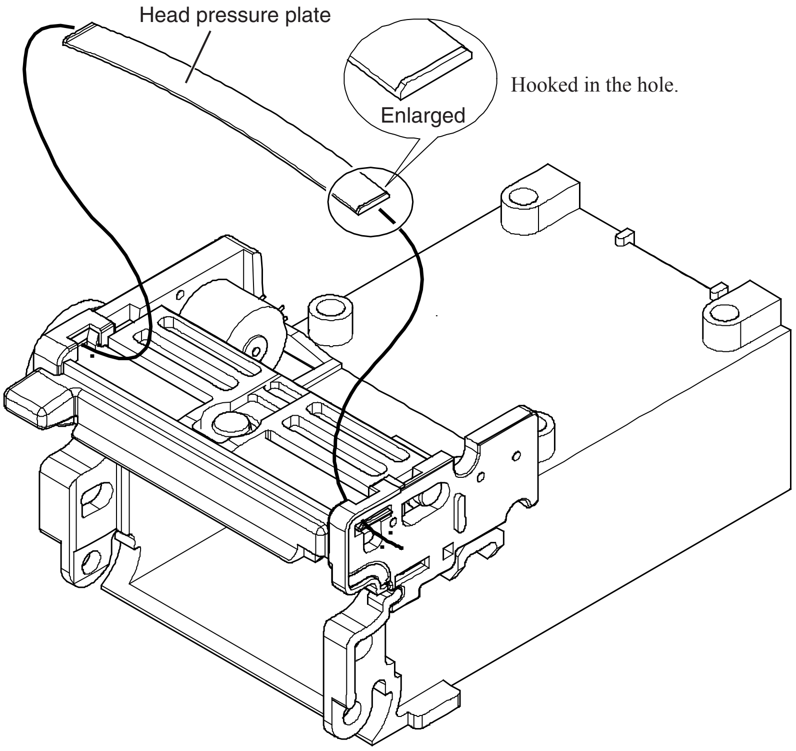
1. Remove the paper drive unit (RG-501X/502X). For details, refer to “Disassembling the Recorder Module (WS-671P)”.
2. Insert the flathead screwdriver into the position shown below and remove Magazine door assy (YS-086P9).



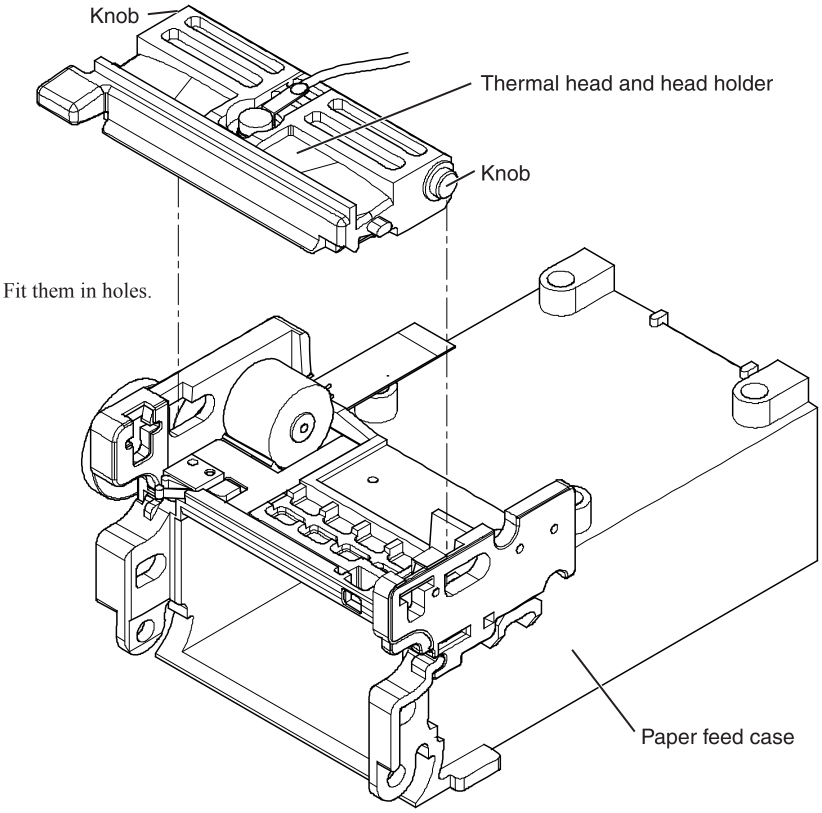
When installing, put the Magazine door assy as shown below.



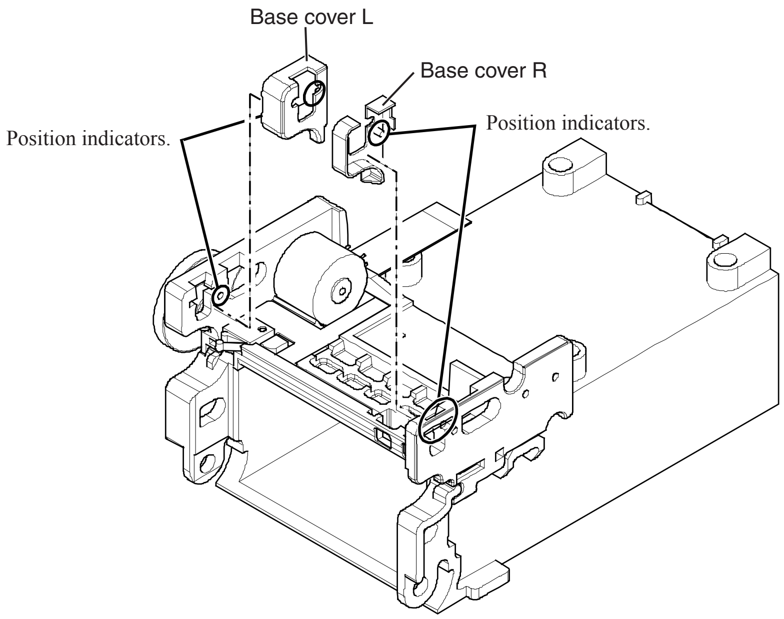
3. Slide the head pressure plate while holding down its center and remove it.


Head pressure plate
Enlarged
Hooked in the hole.

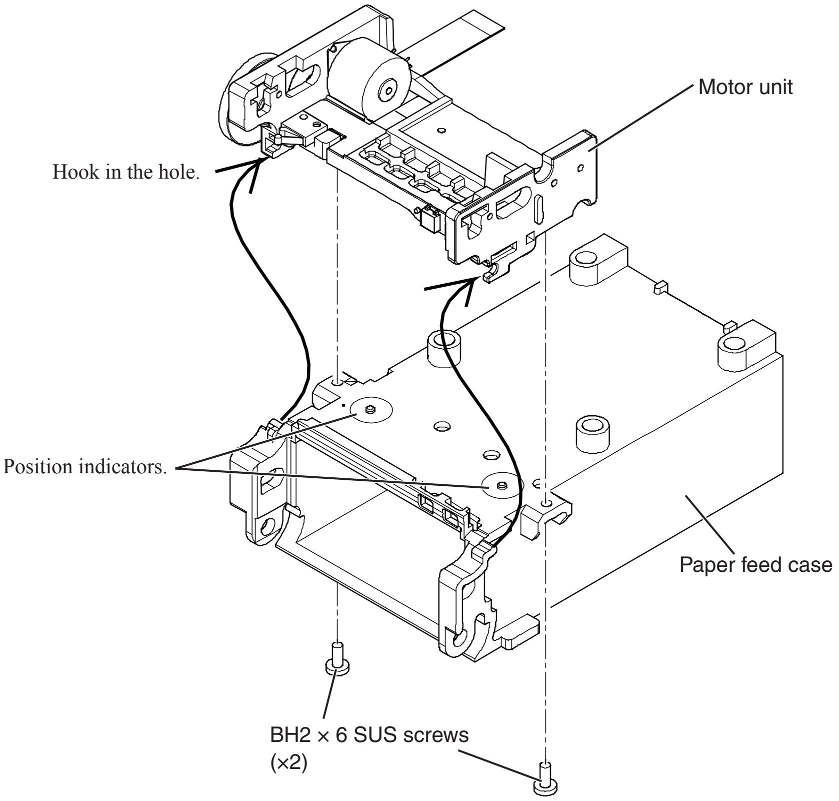
4. Remove the right and left knobs of the base cover installed in the paper feed case and remove the thermal head and head holder.


Knob
Thermal head and head holder
Knob
Fit them in holes.
Paper feed case

5. Remove the right and left base covers.


Base cover L
Base cover R
Position indicators.
Position indicators.

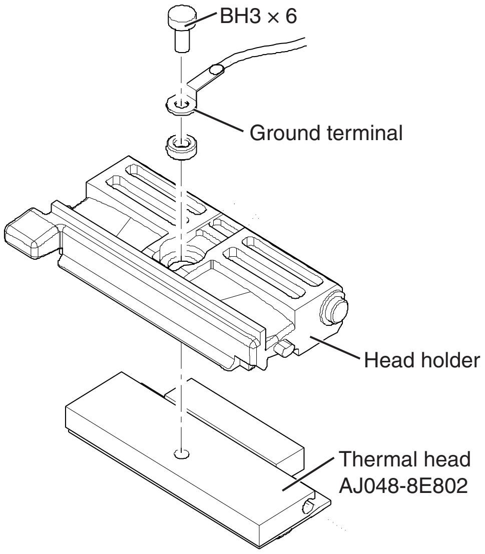
6. Remove the two BH2 × 6 screws from the paper feed case, then remove the motor unit.


Motor unit
Hook in the hole.
Position indicators.
Paper feed case
BH2 × 6 SUS screws
(×2)

Replacing the Thermal Head

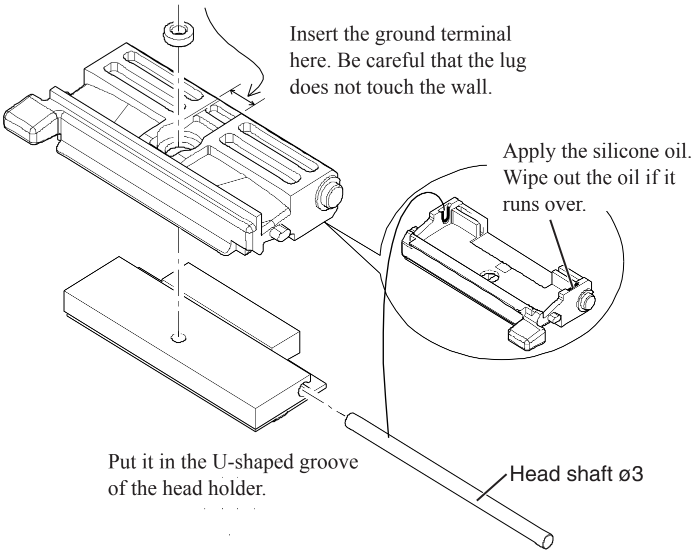
1. Remove the head pressure plate from RG-501X. Remove the right and left knobs of the base cover installed in the paper feed case and then the thermal head and head holder. For details, refer to “Disassembling the Paper Driver Unit (RG-501X/502X)”.

2. Remove the BH3 × 6 screw from the head holder and remove the thermal head.

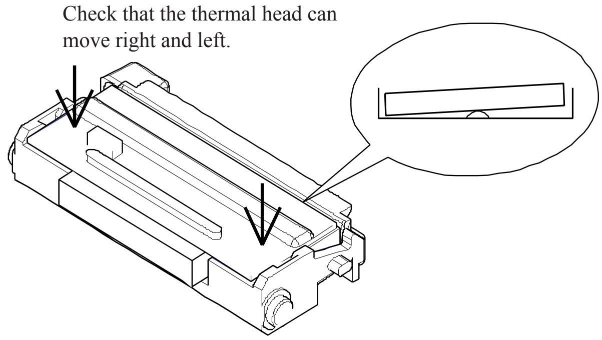

BH3 × 6
Ground terminal
Head holder
Thermal head
AJ048-8E802

Notes on Installing the Thermal Head

1. Pay attention to the installation position of ground terminal. Apply silicone oil to the part in which the head shaft is to be installed.


Insert the ground terminal here. Be careful that the lug does not touch the wall.
Apply the silicone oil. Wipe out the oil if it runs over.
Put it in the U-shaped groove of the head holder.
Head shaft ø3

2. Check that the installed thermal head can move right and left.


Check that the thermal head can
move right and left.

Section 6 Maintenance

Periodic Replacement Parts 6.2
Compatibility between Paper Drive Unit and WS Head Board 6.2
Maintenance Check Items and Schedule 6.3

Periodic Replacement Parts

Types/Part Numbers	Part Names	Remarks	Lifetime
RG-501X	Paper drive unit	Stepping motor included.	Usable for approximately 9000 stacks of the recording paper.
662311	Thermal head	—	Usable for approximately 370 stacks of the recording paper.
YS-086P9	Magazine door assy	Platen roller included.	Usable for approximately 6 years.

Compatibility between Paper Drive Unit and WS Head Board

Note the compatibility of units in WS-671P recorder module.

	UR-3970	UR-39701
RG-501X	✓	
RG-502X		✓

If either one is replaced with a different type due to stock availability, the other one also needs to be replaced with the compatible one.

Maintenance Check Items and Schedule

Perform this maintenance check once every six months.

An inspection record sheet is provided at the end of this section. Make a copy of this inspection record sheet before using it. The check items are grouped as follows.

- Appearance
- Power cord
- Power on
- ROM
- RAM
- FRAM
- VRAM
- Hard key
- Touch key
- RY-910PA remote controller
- Sound
- SD card
- Alarm indicator
- Screen brightness (backinglight)
- WS-671P recorder module
- Date and time
- Battery
- Vital sign parameters
  ECG
  RESP
  SpO_2
  IBP
  NIBP
  TEMP
  CO_2
  O_2
  CO
- Safety
- ZS-900P transmitter
- QF series interface/IF series communication cable
- AG-400R CO_2 unit
- AG-920R multigas unit
- QE-910P BIS processor

Refer to Section 3 “Diagnostic Check and Safety Check” about procedures for each check item.

BSM-6000 series Bedside Monitor
Maintenance Check Sheet

Issuance No. ________________

Facility name	Address of facility	Installation site	Installation date
Date of maintenance check	Sign by engineer who did the maintenance check	Distributor (or service company)	Customer's signature
Instrument model	Instrument serial number	Software version number	Models of main unit and optional units installed

Measuring instrument employed		Attachments/Consumables			
Product name	Maintenance No.	Product name	No.	Product name	No.

Overall judgment	Use situation
[ ] The instrument is working normally.	Status of usage: Continually, Intermittently
[ ] The instrument is working normally but there is/are following minor matter(s). ( )	Duration of usage: year(s)
	Used by: Nurse, Doctor, Technician
[ ] The instrument must be repaired as soon as possible.	

	No.	Item		Check result	Action
Standard Configuration	1	Appearance	Check that there is no dirt, rust, scratch or crack on the instrument.		
			Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the instrument.		
			Check that the instrument has no loose screw.		
			Check that the instrument has no connector and switch loosely attached.		
			Check that the labels on the instrument are not peeled or damaged.		
	2	Power cord	Check that the power cord is not folded and any of the 3 internal wires in the power cord is not exposed.		
			Check the continuity of the 3 internal wires in the power cord with a multimeter.		
	3	Power on	Check that “OK” is displayed at the POWER ON CHECK RESULT on the DIAGNOSTIC CHECK screen.		
	4	ROM	Check the flash ROM on the MAIN DIGITAL board in the MANUAL CHECK mode. Select the ROM from the CPU CHECK items on the MANUAL CHECK screen.		
	5	RAM	Check the Synchronous DRAM on the MAIN DIGITAL board in the MANUAL CHECK mode. Select the RAM from the CPU CHECK items on the MANUAL CHECK screen.		
	6	FRAM	Check the Ferroelectric RAM on the MAIN DIGITAL board in the MANUAL CHECK mode. Select the FRAM from the CPU CHECK items on the MANUAL CHECK screen.		
	7	Hard key	Check the hard keys. Select the HARD KEYS from the CPU CHECK items on the MANUAL CHECK screen.		
	8	Touch key	Check the touch screen. Select the TOUCH KEYS from the CPU CHECK items on the MANUAL CHECK screen.		
	9	Remote controller	Check the optional RY-910PA remote controller. Select the REMOTE from the CPU CHECK items on the MANUAL CHECK screen.		
	10	Sound	Check the alarm sound, QRS synchronization sound and clicky sound. Select the SOUND from the CPU CHECK items on the MANUAL CHECK screen.		
	11	SD card	Check the built-in SD memory card for data storage. Select the SD CARD from the CPU CHECK items on the MANUAL CHECK screen.		
	12	Alarm indicator	Check the alarm indicator. Select the ALARM INDICATOR from the CPU CHECK items on the MANUAL CHECK screen.		
	13	Screen brightness	Check the backlight lamp. Select the BACKLIGHT from the CPU CHECK items on the MANUAL CHECK screen.		
	14	VRAM	Check the VRAM on the MAIN DIGITAL board. Select the VRAM from the GRAPHIC CHECK items on the MANUAL CHECK screen.		
	15	Recorder	Check the optional WS-671P recorder module. Select the WS RECORDER from the COM CHECK items on the MANUAL CHECK screen.		

Standard Configuration	16	NIBP	Check the accuracy of two pressure sensors for NIBP measurement. Select the NIBP from the DPU CHECK items on the MANUAL CHECK screen and select “1. CALIBRATION” on the NIBP CHECK screen.		
			Check the zeroing for NIBP measurement. Select the NIBP on the MANUAL CHECK screen and select “2. ZERO CALIBRATION” on the NIBP CHECK screen.		
			Check the NIBP safety circuit. Select the NIBP on the MANUAL CHECK screen and select “3. SAFETY CHECK” on the NIBP CHECK screen.		
			Check the inflation speed. Select the NIBP on the MANUAL CHECK screen and select “4. INFLATION SPEED” on the NIBP CHECK screen.		
			Check the pressure holding time. Select the NIBP on the MANUAL CHECK screen and select “5. PRESSURE HOLD” on the NIBP CHECK screen.		
			Check the two valves. Select the NIBP on the MANUAL CHECK screen and select “6. STEP DEFLATION” on the NIBP CHECK screen.		
			Check the NIBP circuit. Select the NIBP on the MANUAL CHECK screen and select “8. AIR CIRCUIT” on the NIBP CHECK screen.		
	17	Date/time	Check that the current date and time are properly set on the monitoring screen.		
	18	ECG	Check the heart rate accuracy with an AX-400G vital sign simulator.		
			Check the heart rate alarm, alarm message, alarm sound and alarm indication with BJ-900P ECG patient cable and AX-400G vital sign simulator.		
	19	RESP	Check the respiration rate accuracy with an AX-400G vital sign simulator.		
			Check the respiration rate alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
	20	SpO_2	Check the accuracy of SpO_2 and pulse rate with an AX-400G vital sign simulator.		
			Check the SpO_2 alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
	21	IBP	Check that the zeroing for IBP measurement is within the specified range with an AX-400G vital sign simulator.		
			Check the blood pressure accuracy with an AX-400G vital sign simulator.		
			Check the blood pressure alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the IBP connection cord from the instrument.		
	22	TEMP	Check the temperature accuracy with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the TEMP connection cord from the instrument.		
	23	CO_2	Check that the CO_2 wave, data and respiration rate are properly displayed with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the CO_2 connection cord from the instrument.		
			Check the accuracy of CO_2 sensor with CO_2 calibration gas.		
	24	O_2	Check the O_2 accuracy with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the O_2 connection cord from the instrument.		
	25	CO	Check the accuracy of two temperatures (Tb and Ti) with an AX-400G vital sign simulator.		
			Check the CO accuracy with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the CO connection cord from the instrument.		
	26	Battery	When an optional SB-671P battery pack is used, check the battery pack.		
Safety	27	Check that the earth leakage current is less than prescribed limits.	[ ] µA under normal condition [ ] µA under single-fault condition		
	28	Check that the enclosure leakage current is less than prescribed limits.	[ ] µA under normal condition [ ] µA under single-fault condition		
	29	Check that the patient leakage current is less than prescribed limits.	[ ] µA under normal condition [ ] µA under single-fault condition		
	30	Check that the patient auxiliary current is less than the prescribed limits.	[ ] µA under normal condition [ ] µA under single-fault condition		

ZS-900P transmitter	Instrument serial No.	Version number	Maintenance No.
	Item	Result	Action
	Check that there is no dirt, rust, scratch or crack on the transmitter.		
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the transmitter.		
	Check that the transmitter has no loose screw.		
	Check that the transmitter has no connector and switch loosely attached.		
	Check that the labels on the transmitter are not peeled or damaged.		
	Check that the LED on the transmitter lights green when it is connected to the instrument.		
	Check that the vital sign data and waveforms from the instrument connected to the transmitter are properly received at a receiver and displayed on the receiver screen.		

QF series interface/IF series communication cable	Instrument serial number	Version number	Maintenance No.
	Item	Result	Action
	Check that there is no dirt, rust, scratch or crack on the interface.		
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the interface.		
	Check that the interface has no loose screw.		
	Check that the interface has no connector and switch loosely attached.		
	Check that the labels on the interface are not peeled or damaged.		
	Check that the communication between the interface and instrument is done on the MULTILINK CHECK screen in the MANUAL CHECK mode.		

AG-400R CO_2 unit	Instrument serial number	Version number	Maintenance No.
	Item	Result	Action
	Check that there is no dirt, rust, scratch or crack on the interface.		
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the CO_2 unit.		
	Check that the interface has no loose screw.		
	Check that the interface has no connector and switch loosely attached.		
	Check that the labels on the interface are not peeled or damaged.		
	Check that the CO_2 data is acceptable with a CO_2 calibration gas cylinder.		

AG-920R multigas unit	Instrument serial number	Version number	Maintenance No.
	Item	Result	Action
	Check that there is no dirt, rust, scratch or crack on the multigas unit.		
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the multigas unit.		
	Check that the multigas unit has no loose screw.		
	Check that the multigas unit has no connector and switch loosely attached.		
	Check that the labels on the multigas unit are not peeled or damaged.		
	Check that each gas concentration data is acceptable with a multigas calibration gas cylinder.		

QE-910P BIS processor	Instrument serial number	Version number	Maintenance No.
	Item	Result	Action
	Check that there is no dirt, rust, scratch or crack on the BIS processor.		
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the BIS processor.		
	Check that the BIS processor has no loose screw.		
	Check that the BIS processor has no connector and switch loosely attached.		
	Check that the labels on the BIS processor are not peeled or damaged.		
	Check that there is no error on the screen when the BIS processor is connected to the instrument.		

Section 7 Replaceable Parts List

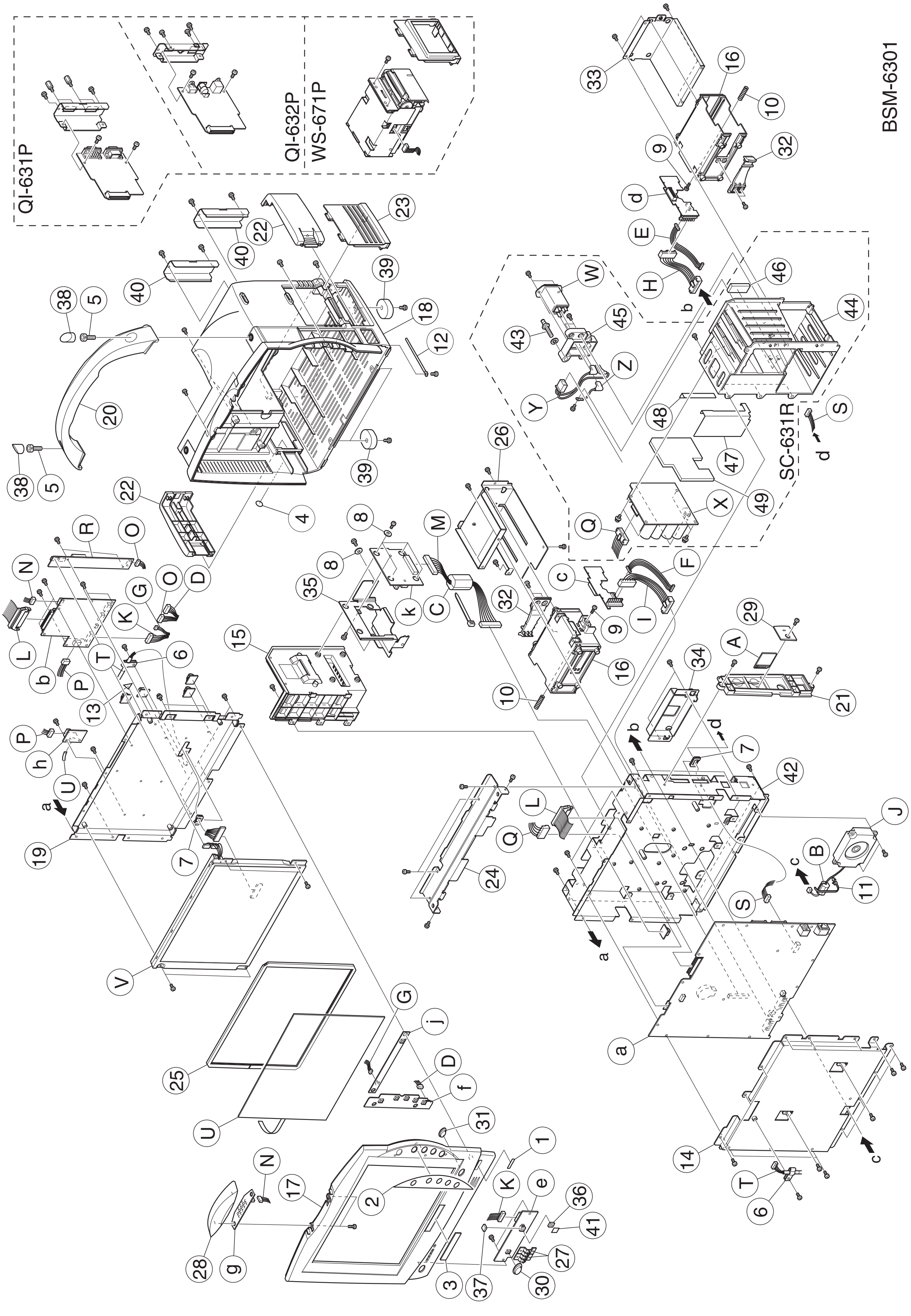
BSM-6301 Bedside Monitor (MU-631R Main Unit)........7.2
BSM-6501 Bedside Monitor (MU-651R Main Unit)........7.5
BSM-6701 Bedside Monitor (MU-671R Main Unit)........7.8
AY-631P/633P Input Unit........7.11
AY-651P/653P Input Unit........7.13
AY-660P/661P/663P/671P/673P Input Unit........7.15
AA-672P/674P Smart Expansion Unit........7.18
WS-671P Recorder Module........7.19
    RG-501X/502X Paper Drive Unit........7.20
Optional Interface Board........7.21
    QI-631P Interface........7.21
    QI-632P Interface........7.21
    QI-634P Interface........7.22
    QI-671P Interface........7.22
    QI-672P Interface........7.23

When ordering parts or accessories from your nearest Nihon Kohden Corporation distributor, please quote the NK code number and part name which are listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs. Always use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

BSM-6301 Bedside Monitor (MU-631R Main Unit)

No.	Part Code	Description	Qty
1	6124-903417	MU-631RA model label	1
	6124-903426	MU-631RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902534	Company logo label	1
4	910338	1-inch “BIS ready” logo label	1
5	289875	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	458612	Edge holder	2
8	579375	Washer	5
9	611964A	Pan head screw	2
10	719955	Ultra spring	2
11	919935	Reuse snapping tie	1
12	922299	Cord clip	1
13	1124-037173B	High voltage label	1
14	6111-901248B	Main shield chassis	1
15	6111-901257C	Connector plate	1
16	6111-901293E	Battery compartment	2
17	6111-902229B	Front enclosure	1
18	6111-902309C	Rear enclosure	1
19	6111-902514B	Main chassis front	1
20	6112-902735C	Handle	1
21	6112-903333C	Side panel	1
22	6112-904377B	Battery cover	2
23	6112-904395B	WS blank panel	1
24	6112-904403A	Handle holder	1
25	6112-904475C	Touch screen packing	1
26	6112-905251A	Battery compartment holder L	1
27	6113-049754B	LED filter	2
28	6113-905187B	Alarm indicator	1
29	6113-906489A	SD blank panel	1
30	6113-906498A	Power key top	1
31	6113-906506B	WS key top	1
32	6113-906658B	Battery lever	2
33	6112-905242A	Battery compartment holder R	1
34	6113-910047A	Spacer plate	1
35	6113-910074	IF ground plate	1
36	6114-137915	Square cover 1	1
37	6114-137924	Square cover 2	1
38	6114-906504C	Handle cap	2
39	6114-908413A	Rubber foot	4
40	6114-912043	Blank panel for option	2
41	6124-901713	IR filter	1
42	6142-900841A	Chassis assy	1
43	551734	Ground terminal	1
44	6111-902211B	Chassis block	1
45	6113-908273B	AC inlet frame	1
46	6114-908725	Gasket	1

No.	Part Code	Description	Qty
47	6114-911944A	Isolation sheet 1	1
48	6114-911953	Isolation sheet 2	1
49	6114-911962	Cooling pad	1
50	6124-035614	Protective earth label	1
51	6124-902712	Attention label	1
A	926767	SD card 256 MB	—
	919552	SD card 128 MB	—
B	442086	Ferrite core	—
C	711384	Sleeve ferrite clamp	—
D	716031	Cable	—
E	716049	Cable	—
F	716058	Cable	—
G	716085	Cable	—
H	716147	Cable	—
I	716156	Cable	—
J	718439	Speaker	—
K	718698	Cable	—
L	721355	Cable	—
M	721364	Cable	—
N	721382	Cable	—
O	721391	Cable	—
P	721899	Cable	—
Q	903034	Cable	—
R	913959	Inverter board	—
S	920033	Cable	—
T	921496	Cable	—
U	914218B	Touch screen	—
V	921504A	10.4 inch LCD unit	—
a	UR-39450	Main digital board	—
b	UR-3956	Front I/F board	—
c	UR-3957	Batt mother 0 board	—
d	UR-39591	Batt mother 1 board	—
—	UR-3962	Front Mother board set	—
e	—	Power SW board	—
f	—	Operation board	—
g	—	Alarm board	—
h	—	Touch panel I/F board	—
j	—	Record key board	—
k	UR-3966	Input I/F board	—
W	718395	AC inlet socket	—
X	916858	Power unit	—
Y	924181	Primary circuit wires	—
Z	613169B	Ground wire	—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WS-671P
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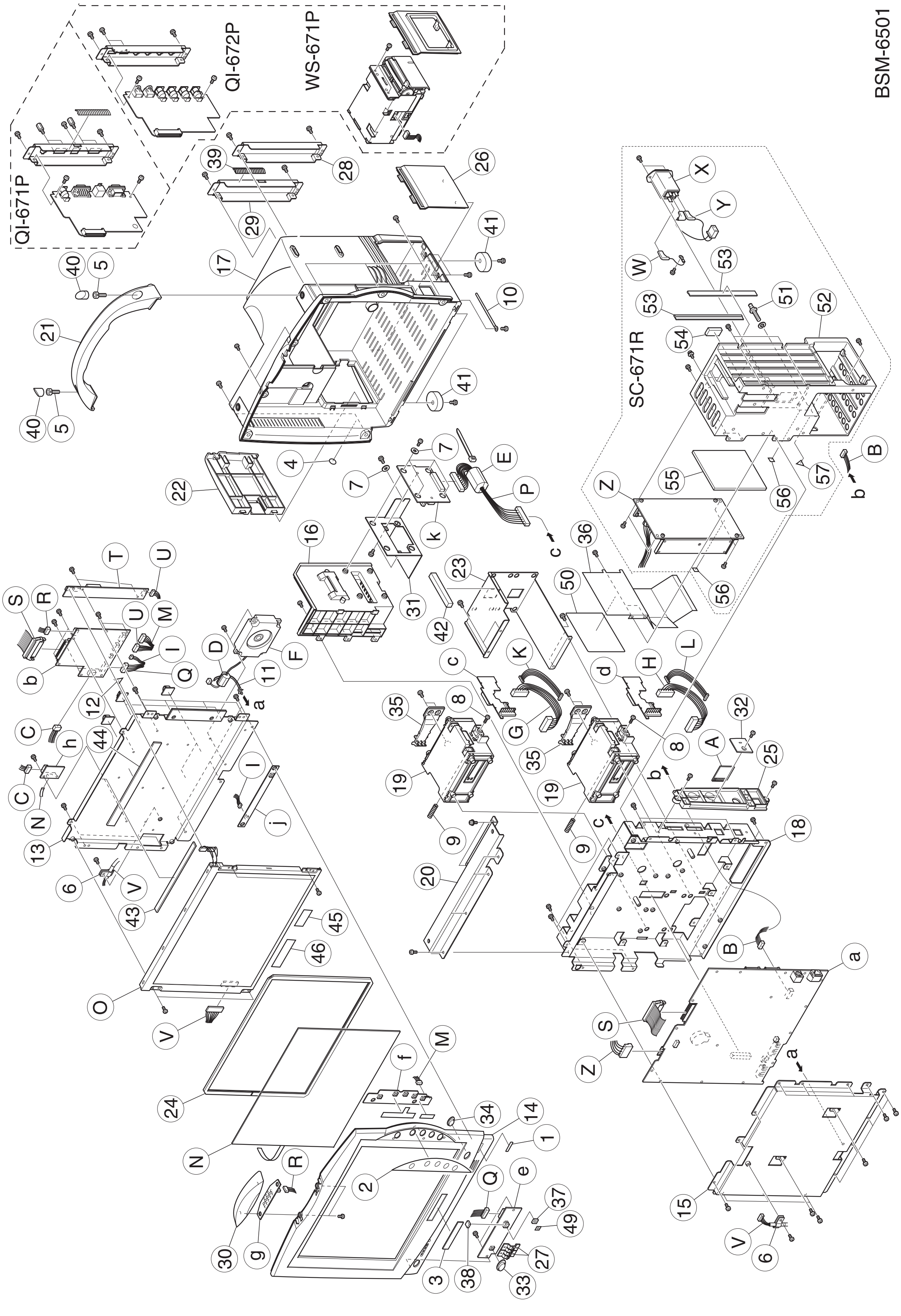
BSM-6501 Bedside Monitor (MU-651R Main Unit)

No.	Part Code	Description	Qty
1	6124-902204	MU-651RA model label	1
	6124-902213	MU-651RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902543	Company logo label	1
4	910338	1-inch “BIS ready” logo label	1
5	289848	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	579375	Washer	5
8	611964A	Pan head screw	2
9	719955	Ultra spring	2
10	722202	Cord clip	1
11	919935	Reuse snapping tie	1
12	1124-037173B	High voltage label	1
13	6111-901186B	Main chassis front	1
14	6111-901212D	Front enclosure	1
15	6111-901248B	Main shield chassis	1
16	6111-901257C	Connector plate	1
17	6111-901275C	Rear enclosure	1
18	6111-901284C	Rear frame chassis	1
19	6111-901293E	Battery compartment	2
20	6112-902691A	Handle holder	1
21	6112-902735C	Handle	1
22	6112-902762C	Battery cover	1
23	6112-902771B	Battery compartment holder	1
24	6112-903315B	Touch screen packing	1
25	6112-903333C	Side panel	1
26	6112-903342B	WS blank panel	1
27	6113-049754B	LED filter	2
28	6113-905151C	Blank panel for QI-ML	1
29	6113-905169C	Blank panel for QI-MIX	1
30	6113-905187B	Alarm indicator	1
31	6113-905196C	IF ground plate	1
32	6113-906489A	SD blank panel	1
33	6113-906498A	Power key top	1
34	6113-906506B	WS key top	1
35	6113-906658B	Battery lever	2
36	6113-907568A	Power insulator	1
37	6114-137915	Square cover 1	1
38	6114-137924	Square cover 2	1
39	6114-139397	EMI gasket	1
40	6114-906504C	Handle cap	2
41	6114-908413A	Rubber foot	4
42	6114-908734	Gasket	1
43	6114-908761	Sealer L160	1
44	6114-908779	Sealer L200	1
45	6114-909065	Conductive tape 25 × 50	1
46	6114-909074	Conductive tape 25 × 100	1

No.	Part Code	Description	Qty
49	6124-901713	IR filter	1
50	6124-902793	Discharge switch description label	1
51	551734	Ground terminal	1
52	6111-901266C	Unit chassis	1
53	6114-908716	Sealer L130	2
54	6114-908725	Gasket	1
55	6114-909056	Cooling pad	1
56	6124-035614	Protective earth label	2
57	6124-902712	Attention label	1
A	926767	SD card 256 MB	—
	919552	SD card 128 MB	—
B	920033	Cable	1
C	721899	Cable	1
D	442086	Ferrite core	1
E	711384	Sleeve ferrite clamp	1
F	718439	Speaker	1
G	716156	Cable	1
H	716147	Cable	1
I	716085	Cable	1
K	716058	Cable	1
L	716049	Cable	1
M	716031	Cable	1
N	916885	Touch screen	1
O	916359	12.1 inch LCD unit	1
P	721364	Cable	1
Q	718698	Cable	1
R	721382	Cable	1
S	721355	Cable	1
T	913959	Inverter board	1
U	721391	Cable	1
V	722104A	Cable	1
W	613169B	Ground wire	—
X	718395	AC inlet socket	—
Y	916911B	Primary circuit wires	—
Z	916867	Power unit	—
a	UR-3945	Main digital board	—
b	UR-3956	Front I/F board	—
c	UR-3957	Batt mother 0 board	—
d	UR-3959	Batt mother 1 board	—
—	UR-3962	Front Mother board set	—
e	—	Power SW board	—
f	—	Operation board	—
g	—	Alarm board	—
h	—	Touch panel I/F board	—
j	—	Record key board	—
k	UR-3966	Input I/F board	—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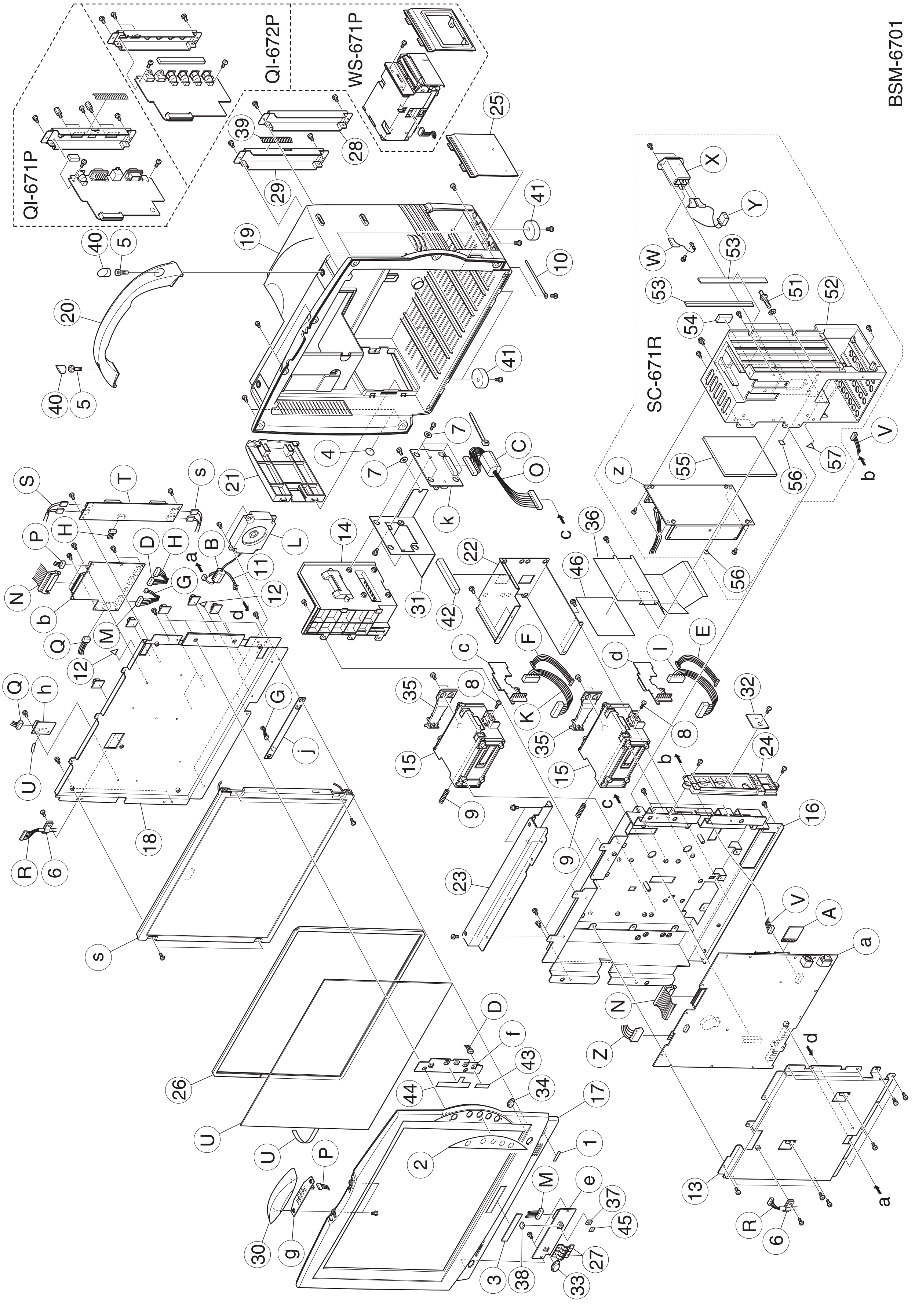
BSM-6701 Bedside Monitor (MU-671R Main Unit)

No.	Part Code	Description	Qty
1	6124-902231	MU-671RA model label	1
	6124-902249	MU-671RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902543	Company logo label	1
4	910338	1-inch “BIS ready” logo label	1
5	289848	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	579375	Washer	5
8	611964A	Pan head screw	2
9	719955	Ultra spring	2
10	722202	Cord clip	1
11	919935	Reuse snapping tie	1
12	1124-037173B	High voltage label	2
13	6111-901248B	Main shield chassis	1
14	6111-901257C	Connector plate	1
15	6111-901293E	Battery compartment	2
16	6111-901346B	Rear frame chassis	1
17	6111-901355D	Front enclosure	1
18	6111-901364B	Main chassis front	1
19	6111-901373C	Rear enclosure	1
20	6112-902735C	Handle	1
21	6112-902762C	Battery cover	1
22	6112-902771B	Battery compartment holder	1
23	6112-902824A	Handle holder	1
24	6112-903333C	Side panel	1
25	6112-903342B	WS blank panel	1
26	6112-903458C	Touch screen packing	1
27	6113-049754B	LED filter	2
28	6113-905151C	Blank panel for QI-ML	1
29	6113-905169C	Blank panel for QI-MIX	1
30	6113-905187B	Alarm indicator	1
31	6113-905392A	IF ground plate	1
32	6113-906489A	SD blank panel	1
33	6113-906498A	Power key top	1
34	6113-906506B	WS key top	1
35	6113-906658B	Battery lever	2
36	6113-907568A	Power insulator	1
37	6114-137915	Square cover 1	1
38	6114-137924	Square cover 2	1
39	6114-139397	EMI gasket	1
40	6114-906504C	Handle cap	2
41	6114-908413A	Rubber foot	4
42	6114-908734	Gasket	1
45	6124-901713	IR filter	1
46	6124-902793	Discharge switch description label	1
51	551734	Ground terminal	1
52	6111-901266C	Unit chassis	1

No.	Part Code	Description	Qty
53	6114-908716	Sealer L130	2
54	6114-908725	Gasket	1
55	6114-909056	Cooling pad	1
56	6124-035614	Protective earth label	2
57	6124-902712	Attention label	1
A	926767	SD card 256 MB	—
	919552	SD card 128 MB	—
B	442086	Ferrite core	—
C	711384	Sleeve ferrite clamp	—
D	716031	Cable	—
E	716049	Cable	—
F	716058	Cable	—
G	716085	Cable	—
H	716129	Cable	—
I	716147	Cable	—
K	716156	Cable	—
L	718439	Speaker	—
M	718698	Cable	—
N	721355	Cable	—
O	721364	Cable	—
P	721382	Cable	—
Q	721899	Cable	—
R	722096	Cable	—
S	—	Cable	—
T	913968	Inverter board	—
U	914209	Touch screen	—
V	920033	Cable	—
W	613169B	Ground wire	—
X	718395	AC inlet socket	—
Y	916911B	Primary circuit wires	—
Z	916867	Power unit	—
a	UR-39451	Main digital board	—
b	UR-3956	Front I/F board	—
c	UR-3957	Batt mother 0 board	—
d	UR-3959	Batt mother 1 board	—
—	UR-3962	Front Mother board set	—
e	—	Power SW board	—
f	—	Operation board	—
g	—	Alarm board	—
h	—	Touch panel I/F board	—
j	—	Record key board	—
k	UR-3966	Input I/F board	—
s	913941B	15 inch LCD display	—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WS-671P
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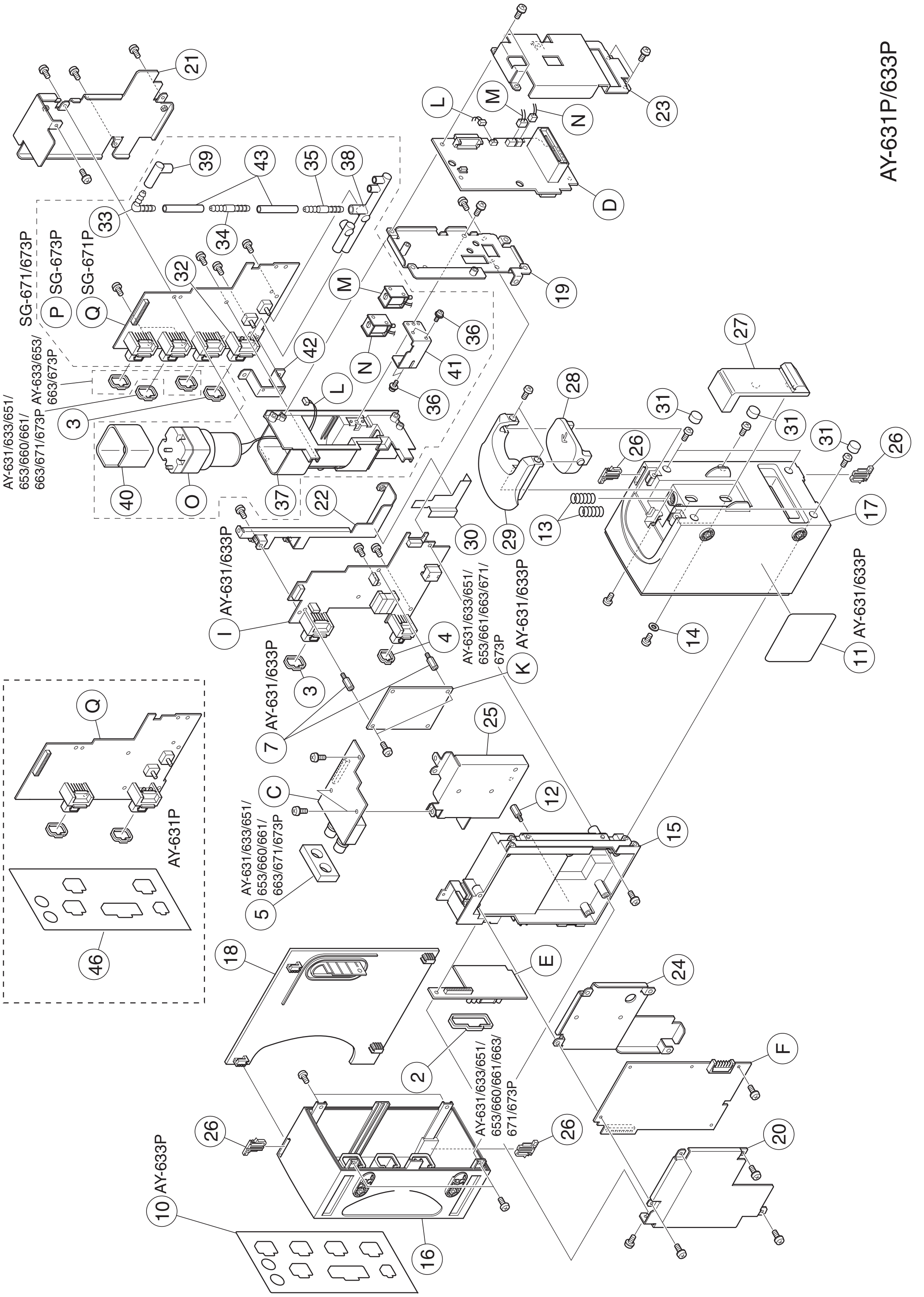
AY-631P/633P Input Unit

No.	Part Code	Description	Qty
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
7	719732	Spacer bolt	2
10	6123-902189B	AY-633P panel (MASIMO 3MP)	1
11	6124-902285	MASIMO patent label MS-13	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203C	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration damping sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
46	6123-902171B	AY-631P panel (MASIMO 1MP)	1
C	UR-3940	TEMP board	—
D	UR-3949	AY Mother (Input mother) board	—
E	UR-3950	ECG connector board	—
F	UR-3951	ECG RESP board	—
I	UR-39721	MPU PWR board	—
K	911765	MS-13 board	—
L	532131A	Cable	—

7. REPLACEABLE PARTS LIST

No.	Part Code	Description	Qty
M	611394C	Valve (orifice: 0.5 mm in dia.)	—
N	622364A	Valve (orifice: 1 mm in dia.)	—
O	532149B	Rolling pump	—
P	UR-39373	MPU board for AY-633P	—
Q	UR-39371	MPU board for AY-631P	—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SG-671/673P
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Q SG-671P
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AY-633P
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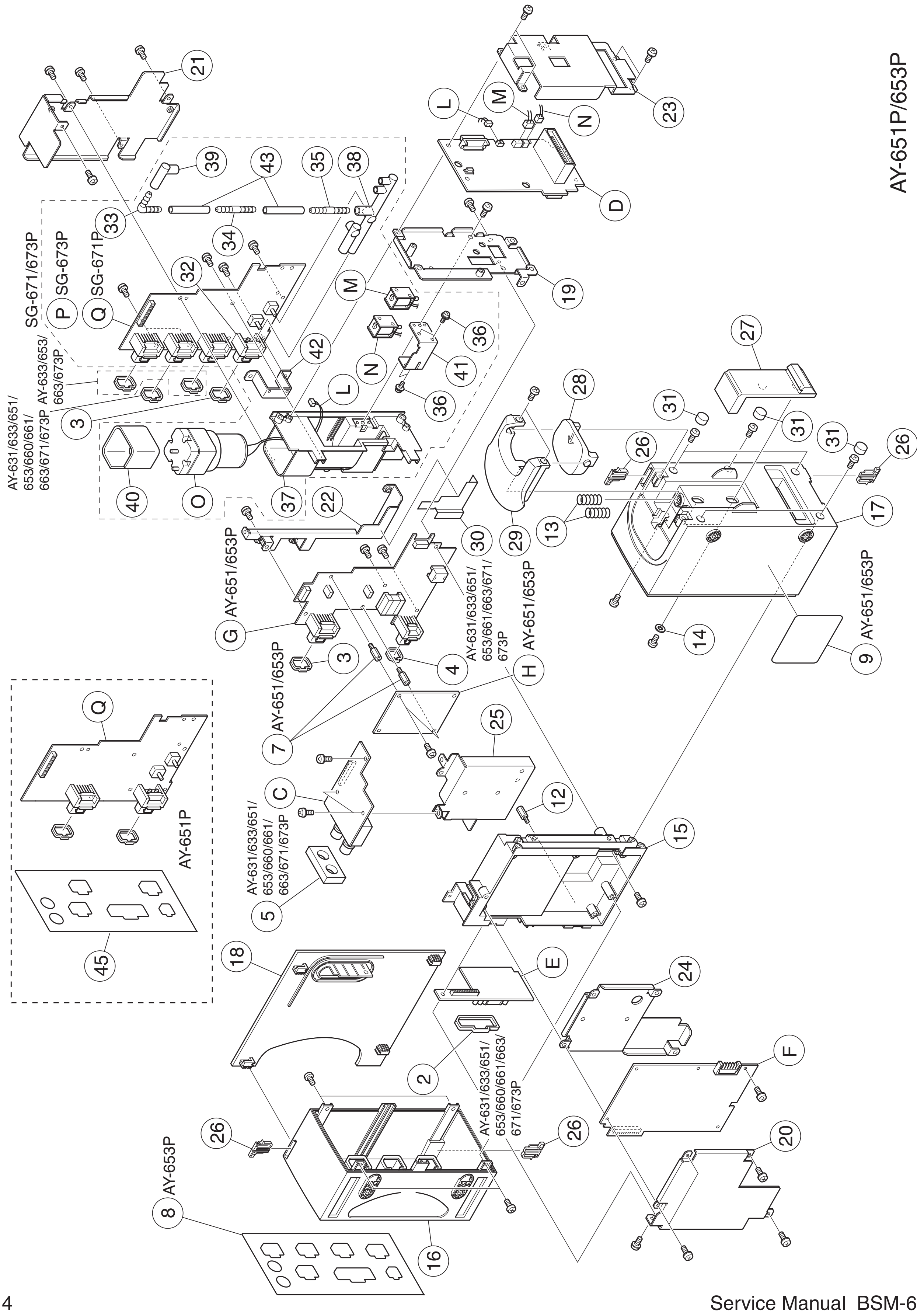
AY-651P/653P Input Unit

No.	Part Code	Description	Qty
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
7	719732	Spacer bolt	2
8	6123-902206B	AY-653P panel (NELCOR 3MP)	1
9	6124-042232	NELLCOR patent label NELL3	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203C	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration damping sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
45	6123-902198B	AY-651P panel (NELCOR 1MP)	1
C	UR-3940	TEMP board	—
D	UR-3949	AY Mother (Input mother) board	—
E	UR-3950	ECG connector board	—
F	UR-3951	ECG RESP board	—
G	UR-3972	MPUPWR board	—
H	719697	NELL 1 oximax pulse oximetry module	—
L	532131A	Cable	—

No.	Part Code	Description	Qty
M	611394C	Valve (orifice: 0.5 mm in dia.)	—
N	622364A	Valve (orifice: 1 mm in dia.)	—
O	532149B	Rolling pump	—
P	UR-39373	MPU board for AY-653P	—
Q	UR-39371	MPU board for AY-651P	—


AY-651P/653P
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SG-671/673P
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Q SG-671P
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AY-631/633/651/653/660/661/663/671/673P
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8 AY-653P
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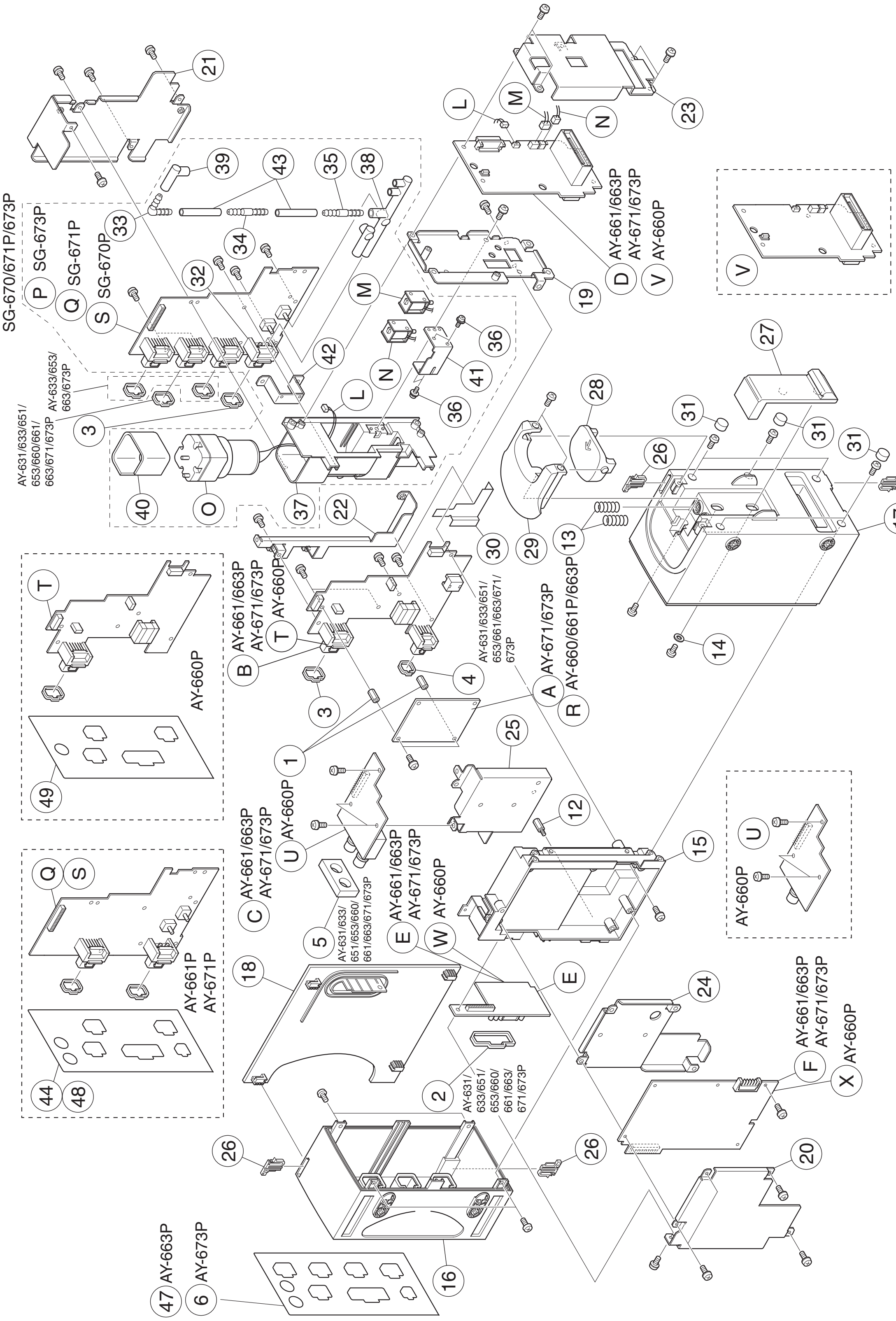
AY-660P/661P/663P/671P/673P Input Unit

No.	Part Code	Description	Qty
1	128078	Spacer nut	2
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
6	6123-902224A	AY-673P panel	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203C	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
44	6123-902215A	AY-671P panel (NK 1MP)	1
47	6123-902581	AY-663P panel (NK 3MP)	1
48	6123-902572	AY-661P panel (NK 1MP)	1
49	6123-903161B	AY-660P panel (NK 1MP)	1
A	UR-39081	SpO_2 board for AY-671P/673P	—
B	UR-3938	MPUPWR board	—
C	UR-3940	TEMP board	—
D	UR-3949	AY Mother (Input mother) board	—
E	UR-3950	ECG connector board	—
F	UR-3951	ECG RESP board	—

No.	Part Code	Description	Qty
L	532131A	Cable	—
M	611394C	Valve (orifice: 0.5 mm in dia.)	—
N	622364A	Valve (orifice: 1 mm in dia.)	—
O	532149B	Rolling pump	—
P	UR-39373	MPU board for AY-663P/673P	—
Q	UR-39371	MPU board for AY-661P/671P	—
R	UR-3908	SpO_2 board for AY-660P/661P/663P	—
S	UR-39370	MPU board for AY-660P	—
T	UR-39380	MPU PWR board for AY-660P	—
U	UR-39400	TEMP board for AY-660P	—
V	UR-39490	Input mother board for AY-660P	—
W	UR-39500	ECG connector board for AY-660P	—
X	UR-39510	ECG RESP board for AY-660P	—

AY-660P/661P/663P/671P/673P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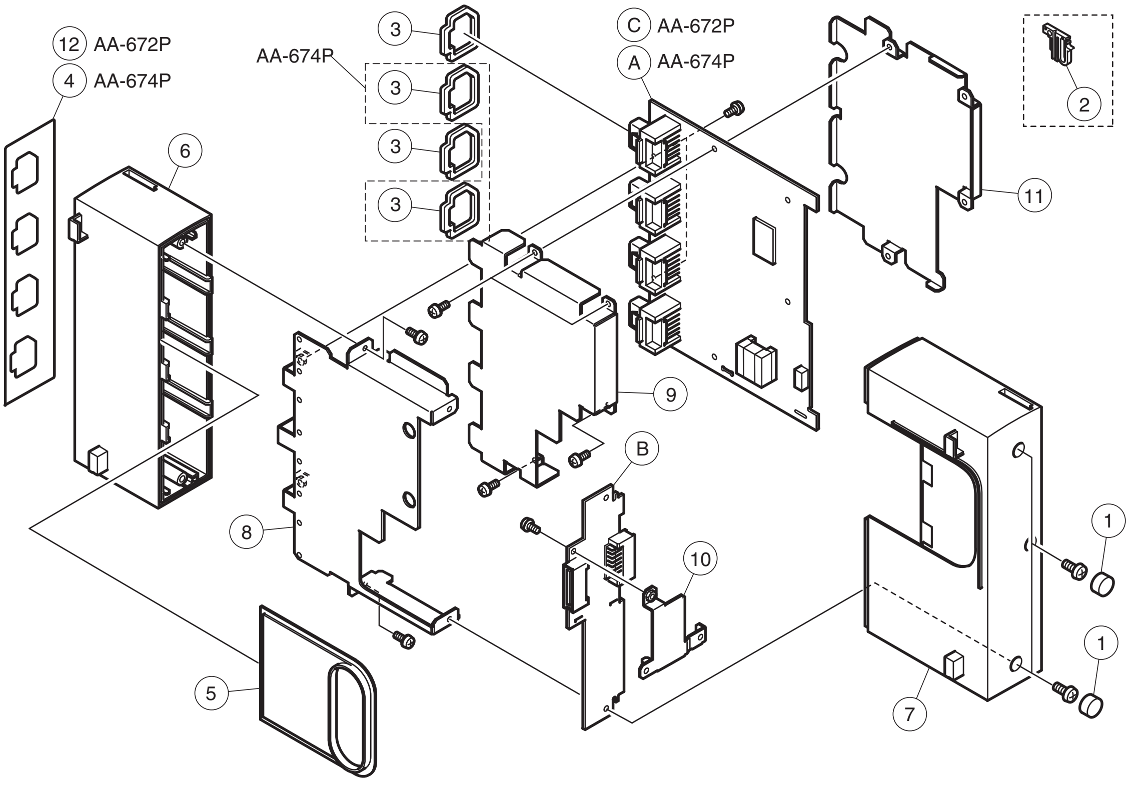
AA-672P/674P Smart Expansion Unit

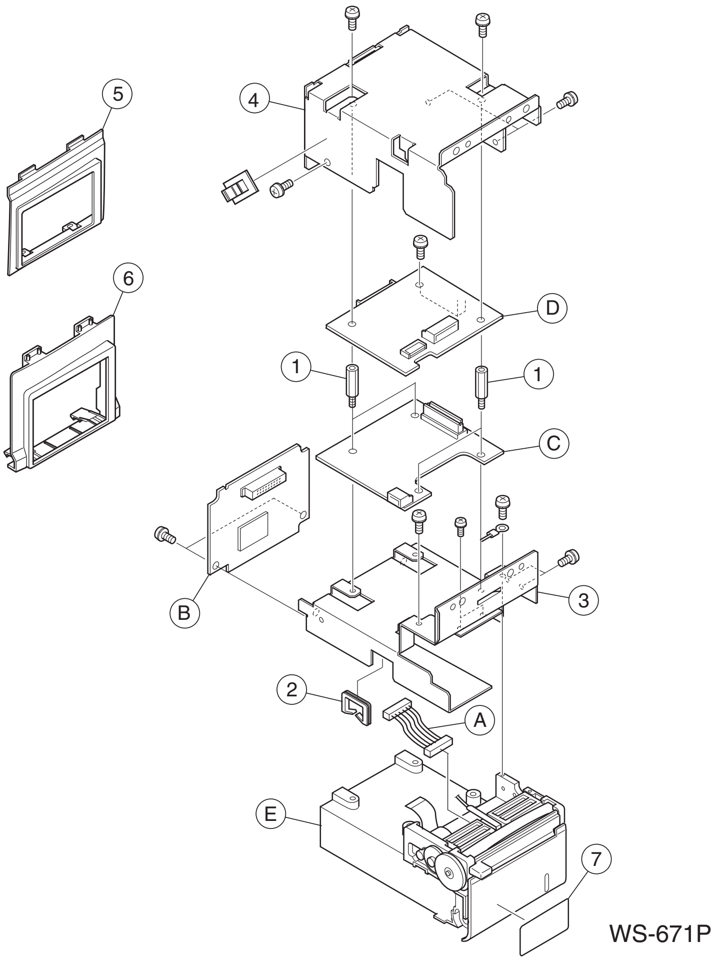
No.	Part Code	Description	Qty
1	6114-908681C	Rubber cap	3
2	6113-905258B	Lock (4MP)	4
3	6114-137194	15P connector packing	4
4	6123-902144	AA-674P panel	1
5	6113-904883C	Side panel (R) 4MP	1
6	6111-901168C	Front case (4MP)	1
7	6111-901177C	Rear case (4MP)	1
8	6112-902486A	Shield chassis (4MP)	1
9	6113-904918C	Shield plate 1 (4MP)	1
10	6113-904927A	Shield plate mother 1 (4MP)	1
11	6112-902503B	Shield plate 2 (4MP)	1
12	6123-902135	AA-672P panel	1
A	UR-39464	EXTMPU board for AA-674P	—
B	UR-3947	EXTMPU PWR board	—
C	UR-39462	EXTMPU board for AA-672P	—



AA-672P/674P

WS-671P Recorder Module

No.	Part Code	Description	Qty
1	127961A	Spacer bolt	4
2	458612	Edge holder	1
3	6112-902726C	WS unit chassis	1
4	6112-903235B	WS unit shield cover	1
5	6112-903396B	WS front cover M	1
6	6112-904573B	WS front cover L	1
7	6124-902356	Recording paper type name sticker FQW 2	1
A	716138	Wire harness	—
B	UR-3941	WS-main board	—
C	UR-3942	WS-power board	—
D	UR-3970/39701	WS-head board	—
E	RG-501X/502X	Paper drive unit	—

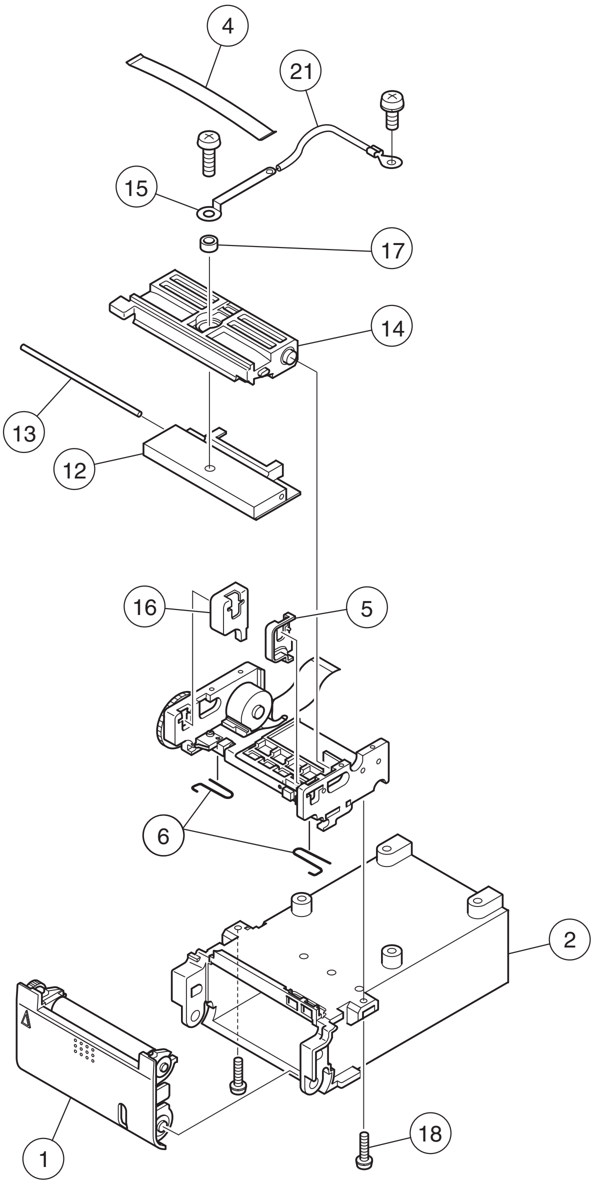


RG-501X/502X Paper Drive Unit

No.	Part Code	Description	Qty
1	YS-086P9	Magazine door assy	1
2	6113-050235C	Paper feed case	1
4	6114-908494	Head pressure plate	1
5	6114-136551A	Base cover R	1
6	6114-135463B	Magazine spring	2
12	662311A	Thermal head	1
13	6114-135445A	Head shaft	1
14	6113-050226B	Head holder	1
15	6114-073378A	Ground terminal	1
16	6114-136542A	Base cover	1
17	6114-135454A	M3 spacer	1
18	366792	BH2 × 6 SUS screw	2
21	662668A	Wire lead	1

NOTE

Parts other than listed above cannot be replaced. Replacement of the whole RG-501X/502X is necessary.

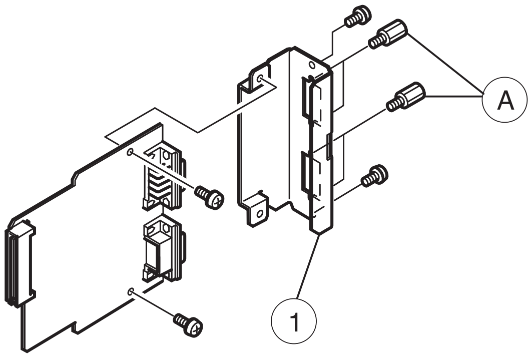


RG-501X

Optional Interface Board

QI-631P Interface

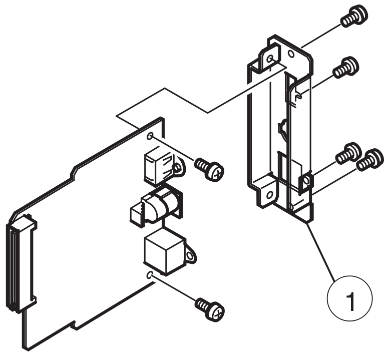
No.	Part Code	Description	Qty
1	6123-902411A	Panel chassis MIX	1
A	919436	Set screw	—



QI-631P

QI-632P Interface

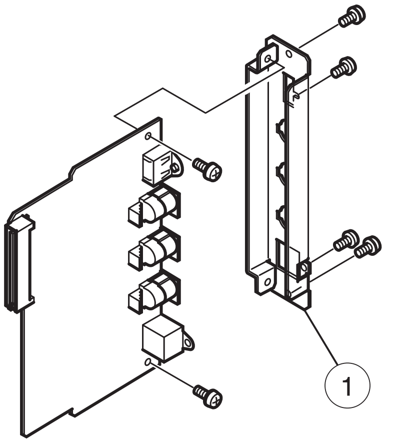
No.	Part Code	Description	Qty
1	6123-902429A	Panel chassis ML	1



QI-632P

QI-634P Interface

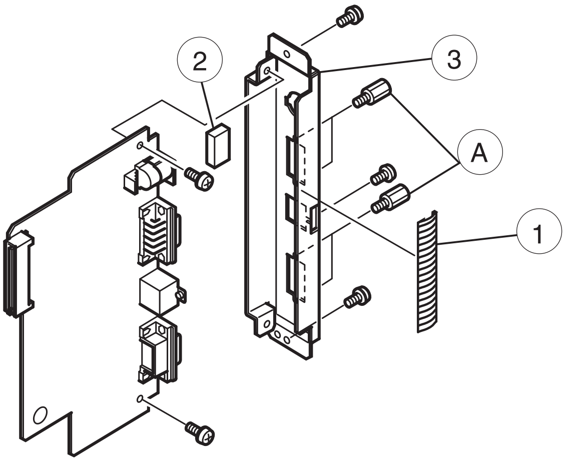
No.	Part Code	Description	Qty
1	6123-903099	Panel chassis ML	1



QI-634P

QI-671P Interface

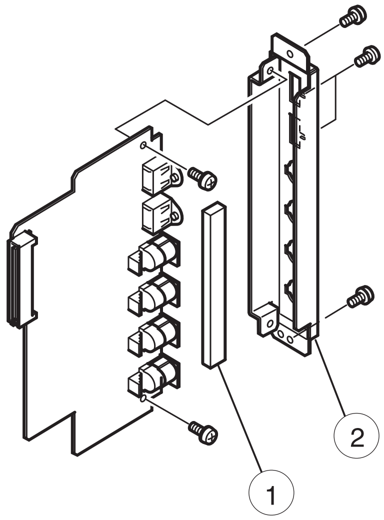
No.	Part Code	Description	Qty
1	6114-139397	EMI gasket	1
2	6114-909038	Sealer	1
3	6123-902322B	Panel chassis MIX	1
A	919436	Set screw	—



QI-671P

QI-672P Interface

No.	Part Code	Description	Qty
1	6114-909047	Sealer	1
2	6123-902331A	Panel chassis ML	1



QI-672P

Manufacturer

NIHON KOHDEN CORPORATION

1-31-4 Nishiochiai, Shinjuku-ku
Tokyo 161-8560, Japan
Phone +81 (3) 5996-8036
Fax +81 (3) 5996-8100

EC REP European Representative

NIHON KOHDEN EUROPE GmbH

Raiffeisenstrasse 10
61191 Rosbach v.d.H., Germany
Phone +49 6003 827-0
Fax +49 6003 827-599

NIHON KOHDEN ITALIA S.r.l.

Via San Tomaso 78
24121 Bergamo, Italy
Phone +39 035 219543
Fax +39 035 232546

NIHON KOHDEN IBERICA S.L.

C/Ulises 75A
28043 Madrid, Spain
Phone +34 917 161 080
Fax +34 913 004 676

NIHON KOHDEN AMERICA, INC.

90 Icon Street, Foothill Ranch, CA 92610, USA
Phone +1 (949) 580-1555
Fax +1 (949) 580-1550

NIHON KOHDEN FRANCE SARL

8, rue Francois Delage, 94230 Cachan, France
Phone +33 1 49 08 05 50
Fax +33 1 49 08 93 32

NIHON KOHDEN FIRENZE S.r.l.

Via Torta 72/74
50019 Sesto Fiorentino (FI), Italy
Phone +39 055 3045 1
Fax +39 055 308548

NIHON KOHDEN TRADING (SHANGHAI) CO., LTD

5F Hui Jin Business Mansion
No. 259 Wuzhong Road, Shanghai 201103, China
Phone +86 (21) 6270-0909
Fax +86 (21) 6270-9700

Beijing Branch
Room 1501, East Ocean Centre
No. 24A JianGuoMenWai Street, Beijing, 100004
Phone 010-6515-5750
Fax 010-6515-5758

Guangzhou Branch
Room 2514, Yian Plaza
No. 33 Jian She Liu Ma Road, Guangzhou, 510060
Phone 020-8363-3737
Fax 020-8363-3807

NIHON KOHDEN SINGAPORE PTE LTD

1 Maritime Square, #10-34 (Lobby C), Harbour Front Centre
Singapore 099253
Phone +65 6376-2210
Fax +65 6376-2264

NIHON KOHDEN KOREA, INC.

Hannam Tower Annex Bldg. Suite 203
730 Hannam-dong, Yongsan-gu, Seoul, Korea 141-210
Phone +82 (2) 3273-2310
Fax +82 (2) 3273-2352

The model and serial number of your instrument are identified on the rear or bottom of the unit.
Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, mention these two pieces of information for quick and accurate service.

Model ______________________ Serial number ______________________

Your Distributor

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